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CANADIAN TRANSPORT COMMISSION

REGULATIONS FOR THE TRANSPORTATION OF DANGEROUS COMMODITIES BY RAIL

Government Publications

CANADIAN TRANSPORT COMMISSION

REGULATIONS

— for the —

TRANSPORTATION OF DANGEROUS COMMODITIES BY RAIL

Published by —
D.G. Systems & Supplies Inc.
Mississauga, Ontario

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Published by D.G. Systems & Supplies Inc.
Mississauga, Ontario

Available by mail from:

Markmaster-Monette
2395 Cawthra Rd.,
Unit 10, Mississauga, Ontario, L5A 2W8

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REGULATIONS

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TRANSPORTATION OF DANGEROUS COMMODITIES BY RAIL

AMENDMENT SERVICES

FIRST AMENDMENT

March, 1986



Published by —
D.G. Systems & Supplies Inc.
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NOTICE OF FIRST AMENDMENT

The Regulations for the Transportation of Dangerous Commodities by Rail was republished in its entirety in January, 1986. At that time, the text appearing in it was up to date. The purpose of this amendment service is to keep the manual continuously up to date with changes in the regulations which it contains. The notation "Revised" appears at the bottom of each page embodying amendments. All pages of the Regulations not bearing such a notation were published on the above-cited date.

This amendment consists of revised texts of the amended sections, the addition of new pages and the removal of pages required by a revoked section. Consequently, to bring your copy of these Regulations up to date, please follow the instructions below:

1. Replace page 132 and 176 with the revised page 132 and 176 which is sent herewith.

2. Insert this page at the beginning of the manual immediately following the cover page.

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EXTRACTS FROM THE RAILWAY ACT

CARRYING DANGEROUS COMMODITIES

Dangerous goods.

295. (1) No passenger shall carry, not except in conformity with any order or regulation made by the Commission in that behalf, shall the company be required to carry upon its railway, gunpowder, dynamite, nitroglycerine, or any other goods that are of a dangerous or explosive nature.

Nature must be marked outside.

(2) Every person who sends by the railway any such goods shall distinctly mark their nature on the outside of the package containing the same, and otherwise give notice in writing to the station agent or employee of the company whose duty it is to receive such goods and to whom the same are delivered. R.S., c. 234, s. 354.

Carrying regulated by Board.

296.(1) The Company shall not carry any goods of an explosive or dangerous nature except in conformity with the regulations made by the Commission in that behalf.

Suspected parcels.

(2) The Company may refuse to take, except in conformity with any order or regulation made by the Commission in that behalf, any package or parcel that it suspects to contain goods of an explosive or dangerous nature, or may require the same to be opened to ascertain the fact. R.S., c. 234, s. 355.

Sending of explosives.

383. Every person who —

(a)sends by any railway any gunpowder, dynamite, nitroglycerine, or any other goods which are of a dangerous or explosive nature, without distinctly marking their nature on the outside of the package containing the same, and otherwise giving notice thereof in writing to the station agent or employee of the company whose duty it is to receive such goods, and to whom the same are delivered; or

Taking them on train. Penalty.

(b) carries or takes upon any train any such goods for the purpose of carriage;

is liable on conviction to a penalty not exceeding two thousand dollars or imprisonment for any period not exceeding two years, or both. R.S., c. 234, s. 439.

Carrying dangerous goods.

384. Every company which carries any goods of an explosive or dangerous nature except in conformity with the regulations, or an order, made by the Commission in that behalf, shall for each such offense incur a penalty of five hundred dollars. R.S., c. 234, s. 440.

GENERAL NOTICE

The regulations contained herein and bearing the title ''Regulations for the Transportation of Dangerous Commodities by Rail'' are prepared and administered by the Canadian Transport Commission. These regulations are applicable to dangerous commodities transported over railways subject to the jurisdiction of the Commission. As successor to the former Board of Transport Commissioners for Canada the Commission has responsibility for the preparation and administration of these regulations. Any reference to that Board found in the text shall be understood to apply to the Commission.

Enquiries relating to the interpretation, amendment or administration of the Commission's dangerous commodities regulations should be directed to the Canadian Transport Commission.

Requests for copies of these regulations should be addressed to Markmaster-Monette, 2395 Cawthra Rd., Unit 10-11, Mississauga, Ontario L5A 2W8.

Enquiries pertaining to freight and express charges for the rail transportation of dangerous commodities should be addressed to the Carrier concerned.

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PART 71 — GENERAL INFORMATION AND REGULATIONS

Sec.

71.1 Scope of the regulations.
71.2 Railway Act.
71.3 Changes to the regulations.
71.4 Changes in specifications for tank cars.
71.5 Procedure covering tank car construction.
71.6 Special permits.
71.7 Public hearings.
71.8 Definitions.
71.9 Reporting of violations, accidents and defective containers.
71.10 Inspections and investigations.
71.14 Dimensions — Metric conversion.
71.15 Approval of Independent Inspection Agency.
71.16 Approval of manufacturers of compressed gas cylinders.
71.17 Approval of impact testing facilities.

§ 71.1 Scope of the Regulations. (a) These regulations (comprising Parts 71 to 79) prescribe safety requirements for the transportation of dangerous goods by railways subject to the jurisdiction of the Canadian Transport Commission and are in addition to regulations made pursuant to the "Transportation of Dangerous Goods Act".

(b) **Numbering and lettering.** The terms used in the numbering and lettering system employed in these regulations are as follows:

(1) Section: A major subdivision of a part, as § 73.193 in Part 73.

(2) Paragraph: A subdivision of a section, as paragraph (c) of this section or § 73.24(c).

(3) Subparagraph: A subdivision of a paragraph, as sub-subparagraph (1) of this paragraph, paragraph (c)(1) of this section or § 73.24(c)(1).

(4) Sub-subparagraph: a subdivision of a subparagraph, as sub-subparagraph (ii), or subparagraph (1)(ii), or paragraph (c)(i)(ii), or § 73.24(c)(1)(ii).

§ 71.2 Railway Act. (a) It is a requirement of §§ 295 and 296 of the Railway Act that dangerous commodities shall not be transported over railways subject to the jurisdiction of the Canadian Transport Commission except in conformity with the Commission's regulations.

(b) §§ 383 and 384 of the Railway Act provide penalties for violation of the Commission's regulations.

§ 71.3 Changes to the Regulations. (a) The development of new types of packaging and packaging materials, the introduction of new commodities to the market, and other similar changes necessitate periodic revision of the regulations. These revisions may be considered by the Commission upon its own motion, or upon application made by any interested party. Such applications shall be supported by sufficient evidence to indicate that there is a practical need for revision, and that the revision can be made without an appreciable reduction of the safety standard.

(b) **Notice of regulation changes.** The period of notice between the issue of new or revised regulations and their effective date shall not be less than 30 calendar days. When practicable, a longer period of notice shall be provided.

§ 71.4 Changes in specifications for tank cars. (a) See § 79.4.

§ 71.5 Procedure covering tank car construction. (a) See § 79.3.

§ 71.6 Special permits; standard requirements and conditions. (a) The Director of Operation, R.T.C., may issue special permits to any person or class of persons granting such exemptions from any of these regulations as he determines will not appreciably lower the standards of safety established hereby.

(b) Unless otherwise specified in the special permit, each shipment made under special permit shall comply with the following:

(1) The outside of each package must be plainly and durably marked, "CTC SP" followed by the number assigned. On portable tanks, and tank cars, such markings must be in letters at least 2 inches high on a contrasting background.

(2) Each shipping document issued in connection with any shipment made under a special permit shall bear the notation "CTC Special Permit No." and the number assigned.

(3) Each holder of a special permit shall furnish a summary of experience to the Canadian Transport Commission before the date of expiration of the permit and when any amendment to the special permit is requested. The holder shall include in the summary the approximate number of packages shipped, and the number of packages involved in any loss of content, including loss by venting when transporting a compressed or cold temperature gas.

(4) Whenever a permit issued to a shipper contains special carrier requirements, the shipper shall furnish a copy of the permit to the carrier.

(c) Each permit is subject to suspension or revocation before its expiration date.

§ 71.7 Public hearings. (a) Public hearings concerning regulations contained herein will be held by the Commission when the Commission considers such hearing advisable. At these hearings evidence may be introduced in favour of proposed changes or additions and protests against the adoption thereof will also be heard. Final action also may be taken by the Commission without hearing, following 20 days' notice by the Commission of proposed changes or additions, or without such notice, as conditions appear to warrant.

§ 71.8 Definitions. (a) In these regulations,

(1) "Commission" or "C.T.C." means the Canadian Transport Commission,

(2) "Committee" or "R.T.C." means the Railway Transport Committee of the Commission,

(3) "dangerous goods" means any product, substance or organism included in any of the classes established by the Transportation of Dangerous Goods Act and the regulations thereunder,

(4) an "empty" car is one having remaining contents not exceeding the percentage referred to in the exception in section 5 of Rule 35 of the Canadian Freight Classification CFC 6000,

(5) "gallon" means the Canadian standard gallon as defined in Schedule II to the Weights and measures Act, chapter 36 of the Statutes of Canada for 1970-71-72,

[1] Special permits may be granted as indicted in § 73.22 (a)(1).

(6) "IMDG Code" means Volumes 1 to 5 of the 1977 Edition of the IMO International Maritime Dangerous Goods Code including amendments 14/1976 and 15/1977 published in 1978, amendments 16/1978 and 17-18/1979 published in 1979, amendment 19/1980 published in 1981 and amendment 20/1982 published in 1983,

(7) "IMO" means the International Maritimes Organization,

(8) "package" means packaging and its contents,

(9) "packaging" means any receptacle or enveloping material used to contain or protect goods, but does not include a vehicle or a container,

(10) "portable tank" means a tank, other than part of a vehicle, that is designed to be loaded into, loaded on or temporarily attached to a vehicle or a ship, that is equipped with skids, mountings or accessories to facilitate handling of the tank by mechanical means, but does not include a multi-unit tank car tank,

(11) "p.s.i.a." means pounds per square inch absolute,

(12) "p.s.i.g." means pounds per square inch gauge,

(13) "railway vehicle" means any vehicle that is designed to be drawn or propelled by any power other than muscular power and that operates exclusively on rail,

(14) "regulations" includes this Part and Parts 72 to 79,

(15) "shall" or "must" imports a mandatory provision and "should" imports a recommendatory provision.

(b) **Classes of Dangerous Goods.** A reference in these regulations to a "class" or a "division" of dangerous goods or to a "packing group" is a reference to the class or division or the packing group established by the Transportation of Dangerous Goods Act and the regulations thereunder, and

(1) "explosives" means dangerous goods belonging to Class 1 pursuant thereto.

(2) "gases" means dangerous goods belonging to Class 2 pursuant thereto, and "poisonous gases" means gases belonging to Division 3 of Class 2 pursuant thereto,

(3) "flammable liquids" means dangerous goods belonging to Class 3 pursuant thereto,

(4) "flammable solids" or "substances liable to spontaneous combustion" or "substances that on contact with water emit flammable gases" mean dangerous goods belonging to Class 4 pursuant thereto,

(5) "oxidizing substances" or "organic peroxides" mean dangerous goods belonging to Class 5 pursuant thereto,

(6) "poisonous liquids" or "poisonous solids" means dangerous goods belonging to Class 6 pursuant thereto,

(7) "radioactive material" mean dangerous goods belonging to Class 7 pursuant thereto,

(8) "corrosives" means dangerous goods belonging to Class 8 pursuant thereto.

§ 71.9 Reporting of Violations, Accidents and Defective Containers. (a) Violations of the Commission's regulations; accidents; leaking, damaged or defective containers, and other similar incidents which occur while a shipment is in the custody of the carrier shall be reported promptly by him to the Director of Operations, Railway Transport, Committee of the Canadian Transport Commission, Ottawa, Ontario.

When any of the above-mentioned conditions involves dangerous commodities or the release of dangerous commodities, or results in a fire, an explosion, an injury or in a loss of life, or creates a serious threat to public safety, a preliminary report shall be submitted immediately by telephone. Subsequent periodic follow-up telephone reports as required by the Committee's officer shall be made. A record of calls required by this paragraph must be made by the railway officer making the calls and retained for a period of at least six months.

(b) Violations of the Commissions regulations; accidents; leaking, damaged or defective containers, and other similar incidents which occur outside of the carrier's custody should be reported by the consignee or the consignor, whichever has knowledge of the event, in accordance with the instructions contained in (a) of this section.

§71.10 Inspections and Investigations. (a) The Commission may authorize inspections and investigations to make these regulations effective. For this purpose, all operations which involve or affect the transportation, handling or storage of dangerous commodities on the property of railway companies subject to the Commission's jurisdiction shall be open to inspection and investigation by inspectors of the Commission.

(b) Inspectors of the Canadian Transport Commission who are authorized to make inspections and investigations as prescribed in this Section are identified by a Canadian Transport Commission certificate.

§ 71.14 Dimensions — Metric Conversion. (a) When dimensions are specified in these regulations by non-metric measure, dimensions measured by SI (metric) may be substituted, on the basis of "soft" metric conversion.

(b) For the purpose of these regulations, "soft" metric conversion is a change of measurement language to SI which may include physical changes not exceeding those permitted by former measurement tolerances.

(c) When quantity limitations are specified by non-metric (Imperial) Liquid measure for 95 gallons or less, or by non-metric mass for 1000 pounds or less, quantities measured by SI (Metric) may be substituted on the basis of five litres per gallon and 500 grams per pound.

(d) When SI measurements are used, specification packagings must be marked to indicate their use and must be tested accordingly.

§ 71.15 Approval of Independent Inspection Agency. (a) (1) Subject to subparagraph 2), any person may apply to the Secretary, Railway Transport Committee, Canadian Transport Commission, to be approved as an Independent Inspection Agency for the purpose of performing packaging inspections and verifications required by these Regulations.

(2) Any person may apply to be designated as an Independent Inspection Agency provided that person:

i) does not manufacture packagings for use in the transportation of dangerous commodities; or

ii) is not directly or indirectly controlled by any person who manufactures packagings for use in the transportation of dangerous commodities; or

iii) does not directly or indirectly control any person who manufactures packagings for use in the transportation of dangerous commodities.

(b) Each application filed under this section must:

(1) Be submitted in writing;

(2) State the name, address, principal business activity, and telephone number of the applicant and the name and address of each facility where tests and inspections are to be performed;

(3) State the name, address, and principal business activity of each person having any direct or indirect ownership interest greater than three percent:

i) in the applicant firm; or

ii) in each subsidiary or division of the applicant firm;

(4) If the applicant is not a permanent resident of Canada, include designation of a permanent resident of Canada as his agent for service of process;

(5) Set forth a detailed description of the inspection and testing facilities to be used by the applicant and the applicant's capability to perform the inspections and verify the tests required by these regulations;

(6) Identify by name each individual whom the applicant proposes to employ as an inspector responsible for certifying inspection and test results and a statement of that person's qualifications; and

(7) Specify the identification or qualification number assigned to each inspector who is supervised by a certifying inspector identified in § 71.15(b)(6).

(c) (1) Upon request, the applicant shall allow a Commission officer to inspect the applicant's testing facilities and to witness the applicant's inspection procedure.

(2) The applicant shall bear the cost relating to such an inspection.

(d) On the basis of its own investigation and on the information submitted in the application pursuant to subparagraph (b), the Railway Transport Committee may issue an order approving an independent inspection agency subject to terms and conditions as it considers necessary.

(e) An order approving an independent inspection agency issued under this section is not transferable and is effective until surrendered or withdrawn or otherwise terminated by the Railway Transport Committee.

(f) Not later than 20 days after any changes occur in the information submitted in the application pursuant to subparagraph (b), the holder shall provide written notification to the Secretary of the Railway Transport Committee of any such changes.

(g) (1) Upon request, the holder of an approval issued under this section shall:

i) allow the Commission's officer to inspect the holder's testing facilities and to witness the holder's inspection procedure; and

ii) make available for inspection, by a Commission Officer, the records pertaining to inspections and verifications required by these Regulations.

(2) The holder shall bear the cost relating to such an inspection.

§ 71.16 Approval of manufacturers of compressed gas cylinders. (a) Any person who manufactures compressed gas cylinders outside Canada may apply to the Commission for approval to have the chemical analyses and tests of these cylinders as required by these Regulations performed outside Canada.

(b) Each application filed under this section must:

i) Be submitted in writing to the Secretary, Railway Transport Committee, Canadian Transport Commission;

ii) State the name, address and telephone number of the applicant and the name, address and a description of each facility at which cylinders are manufactured and chemical analyses and tests are to be performed;

iii) Set forth complete details concerning the dimensions, materials of construction, wall thickness, water capacity, shape, type of joints, location and size of openings and other pertinent physical characteristics of each type of cylinder for which approval is being requested, including calculations for cylinder wall stress and wall thickness which may be shown on a drawing or on separate sheets attached to a descriptive drawing;

iv) Identify the independent inspection agency to be used.

(c) (1) Upon request, the applicant shall allow a Commission officer to inspect the applicant's cylinder manufacturing and testing facilities and shall provide such materials and cylinders for analyses and tests as the officer may specify.

(2) The applicant shall bear the cost of the inspections, analyses and tests.

(d) On the basis of its own investigation and on the information submitted in the application pursuant to paragraph (b) the Committee may issue an order approving the manufacturing and testing facility subject to such terms and conditions as it considers necessary.

(e) An order approving such cylinder manufacturing and testing facility issued under this section is not transferable and is effective until surrendered or withdrawn or otherwise terminated by the Committee.

(f) Not later than 20 days after any changes occur in the information submitted in the application pursuant to paragraph (b), the holder shall provide written notification to the Secretary of the Committee of any such changes.

(g) (1) Upon request, the holder of an approval issued under this section shall allow the Commission's officer to inspect the holder's cylinder manufacturing and testing facilities, any cylinder manufactured under that approval, the holder's inspection and test records, and technical data files pertaining to any cylinder manufactured under that approval.

(2) The holder shall bear the costs relating to such an inspection.

§ 71.17 Approval of impact testing facilities. (a) All the facilities for impact testing located outside of Canada shall be approved in accordance with § 71.15.

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PART 72 — LIST OF COMMODITIES AND PACKAGING REQUIREMENTS

Sec.

72.2 Application
72.5 List of Commodities

§72.2 Application. (a) Dangerous goods that are not listed by specific technical name in section 72.5 are subject to the requirements of these regulations for the listed generic commodity that most aptly describes them.

§72.5 List of Commodities. (a) Commodities identified by the letter "S" in Column 1 are designated as special commodities.

(b) Column 2 lists commodities by name or by generic description.

(c) Column 3 identifies the class and division to which a commodity is assigned by regulations under the **Transportation of Dangerous Goods Act.**

(d) Column 4 indicates the identification number assigned for use in relation to commodities.

(e) Column 5(a) indicates the sections of Part 73 that set forth exemptions to specific packaging requirements applicable to commodities.

(f) Column 5(b) indicates the sections of Part 73 that set forth specific packaging requirements applicable to commodities.

(1) Notes	(2) Commodities	(3) Class	(4) Identification Number	(5) Packaging (a) Exemptions	(5) Packaging (b) Specific Requirements
	Acetal	3.1	1088	73.118	73.119
	Acetaldehyde,	3.1	1089	None	73.119
	Acetaldehyde oxime	3.3	2332	73.118a	None
	Acetic acid, glacial or acetic acid solution, *more than 80% acid, by weight*	8	2789	73.244	73.245
	Acetic acid solution, *more than 10% but not more than 80% acid, by weight*	8	2790	73.244	73.245
	Acetic anhydride,	8	1715	73.244	73.245
	Acetone	3.1	1090	73.118	73.119
S	**Acetone cyanohydrin,**	6.1	1541	None	73.346
	Acetone oils	3.2	1091	73.118	73.119
	Acetonitrile *See* **Methyl cyanide**				
	Acetyl acetone peroxide, *maximum concentration 40% in solution*	5.2	2080	73.153	73.221
	Acetyl benzoyl peroxide, *maximum concentration 45% in solution*	5.2	2081	None	73.222
	Acetyl bromide,	8	1716	73.244	73.247
	Acetyl chloride,	3.2	1717	73.244	73.247
	Acetyl cyclohexane sulphonyl peroxide, *maximum concentration 82%, wetted with minimum 12% water*	5.2	2082	73.153	73.154
	Acetyl cyclohexane sulphonyl peroxide, *maximum concentration 32% in solution*	5.2	2083	73.153	73.221
S	**Acetylene,** *dissolved*	2.1	1001	None	73.303
	Acetyliodide	8	1898	73.244	73.247
	Acetyl methyl carbinol	3.3	2621	73.118a	None
	Acetyl peroxide, *maximum concentration 27% in solution*	5.2	2084	73.153	73.222
	Acid butyl phosphate	8	1718	73.244	73.245
	Acid mixture, *nitrating acid. See* **Nitrating acid mixtures**				
	Acids, liquid, n.o.s. *See* **Corrosive liquids, n.o.s.**				
	Acridine	4.1	2713	73.153	73.154
	Acrolein dimer, *stablized*	3.3	2607	72.118a	None
	Acrolein, *inhibited*	3.1	1092	None	73.122
	Acrylic acid, *inhibited*	8	2218	73.244	73.245
S	**Acrylonitrile,** *inhibited*	3.1	1093	None	73.119
	Activated carbon *See* **Carbon, activated**				
	Activated charcoal *See* **Charcoal, activated**				
	Adhesives *containing a flammable liquid*	3.1	1133	73.118	73.132
		3.2	1133	73.118	73.132
		3.3	1133	73.118a	None
	Aerosols	2.1	1950	73.306	73.302 73.304 73.305
		2.2	1950	73.306	73.302 73.304 73.305
		2.3	1950	73.306	73.302 73.304 73.305
		3.1	1950	73.306	73.302 73.304 73.305
		3.2	1950	73.306	73.302 73.304 73.305
		3.3	1950	73.118a	None
		6.1	1950	73.306	73.302 73.304 73.305
		8	1950	73.306	73.302 73.304 73.305
		9	1950	73.306	73.302 73.304 73.305
	Agents, blasting Type B. *See* **Explosives, blasting, Type B**				
	Agents, blasting Type E. *See* **Explosives, blasting, Type E**				
	Air, *compressed*	2.2	1002	73.306	73.302
	Air, *liquid*	2.2	1003	73.306 73.307	73.302 73.304 73.305
	Aircraft thrust device *for assisted take-off*	4.1	2791	73.153	73.154
	Alarm devices, explosive	1.4	0001	None	73.102
	Alcohol, *denatured*	3.2	1095	73.118	73.119
		3.3	1095	73.118a	None
	Alcohol, *industrial*	3.2	1096	73.118	73.119
		3.3	1096	73.118a	None
	Alcohols, *(non-toxic),* **n.o.s.**	3.2	1987	73.118	73.125
		3.3	1987	73.118a	None
	Alcohols, *(toxic),* **n.o.s.**	3.2	1986	73.118	73.119
		3.3	1986	73.118a	None
	Aldehydes, *(non-toxic),* **n.o.s.**	3.2	1989	73.118	73.119
		3.3	1989	73.118a	None
	Aldehydes, *(toxic),* **n.o.s.**	3.2	1988	73.118	73.119
		3.3	1988	73.118a	None
	Aldol	6.1	2839	73.345	73.346
	Aldrin *mixture,* **liquid** *(more than 60% aldrin)*	6.1	2995	73.345	73.361

(1) Notes	(2) Commodities	(3) Class	(4) Identification Number	(5) Packaging (a) Exemptions	(5) Packaging (b) Specific Requirements
	Aldrin, *or* **aldrin mixture,** *dry (more than 65% aldrin)*	6.1	2761	73.364	73.376
	Alkali metal amalgams, n.o.s.	4.3	1389	73.153	73.154
	Alkali metal amides, n.o.s.	4.3	1390	73.153	73.154
	Alkali metal dispersions, n.o.s.	4.3	1391	73.153	73.154
	Alkali metals, *liquid alloys of*	4.3	1421	None	73.202
	Alkaline caustic liquids, n.o.s. *See* **Caustic alkali liquids, n.o.s.**				
	Alkaline corrosive liquids, n.o.s.	8	1760	73.244	73.249
	Alkaline earth metal amalgams, n.o.s.	4.3	1392	73.153	73.206
	Alkaloids, *(poisonous), and their salts* **n.o.s.**	6.1	1544	73.364	73.365
	Alkyl, aryl or toluene sulphonic acid, liquid *with more than 5% free sulphuric acid*	8	2584	73.244	73.245
	Alkyl, aryl or toluene sulphonic acid, liquid *with not more than 5% free sulphuric acid*	8	2586	73.244	73.245
	Alkyl, aryl or toluene sulphonic acid, solid *with more than 5% free sulphuric acid*	8	2583	73.244	73.245
	Alkyl, aryl or toluene sulphonic acid, solid *with not more than 5% free sulphuric acid*	8	2585	73.244	73.245
	Alkylamines and polyamines, *flashpoint below 23 deg C and boiling point above 35 deg C but not more than 200 deg C* **n.o.s.**	3.2 3.3	2733 2733	73.118 73.118a	73.119 None
	Alkylamines, n.o.s. *or* **polyalkylamine, n.o.s.** *corrosive*	8	2735	73.244	73.245
	Alkylamines, n.o.s. *or* **polyalkylamines, n.o.s.** *corrosive flammable*	8	2734	73.244	73.245
	Alkylamines, n.o.s. *or* **polyalkylamines, n.o.s.** *flammable, corrosive*	3.2	2733	73.118	73.119
	Alloys of alkaline earth metals *(nonpyrophoric)* **n.o.s.**	4.3	1393	73.153	73.154
	Allyl acetate	3.2	2333	73.118	73.119
	Allyl alcohol	3.2	1098	73.118	73.119
	Allylamine	3.1	2334	73.118	73.119
	Allyl bromide	3.2	1099	73.118	73.119
	Allyl chloride	3.1	1100	None	73.119
	Allyl Chlorocarbonate *See* **Allyl chloroformate**				
	Allyl chloroformate	8	1722	None	73.288
	Allyl ethyl ether	3.2	2335	73.118	73.119
	Allyl formate	3.2	2336	73.118	73.119
	Allyl glycidyl ether	3.3	2219	73.118a	None
	Allyl iodide	3.2	1723	73.244	73.245 73.245a
	Allyl isothiocyanate, *inhibited*	6.1	1545	73.345	73.346
	Allyl trichlorosilane, *stabilized*	8	1724	None	73.280
	Aluminum alkylchlorides	4.2	2003	73.153	73.154
	Aluminum alkyl halides, *in solution*	4.2	3052	73.118	73.119
	Aluminum alkyl halides, *pure*	4.2	3052	73.153	73.154
	Aluminum alkyls	4.2	3051	73.118	73.119
	Aluminum borohydride *or* **aluminum borohydride** *in devices*	4.2	2870	72.153	73.154
	Aluminum bromide, *anhydrous*	8	1725	73.244	73.245b
	Aluminum carbide	4.3	1394	73.153	73.154
	Aluminum chloride, *anhydrous*	8	1726	73.244	73.245b
	Aluminum chloride, *solution*	8	2581	73.244	73.245
	Aluminum ferrosilicon, *powder*	4.3	1395	73.153	73.154
	Aluminum hydride	4.3	2463	None	73.206
	Aluminum nitrate	5.1	1438	73.153	73.182
S	**Aluminum phosphide**	4.3	1397	None	73.154
	Aluminum powder, *coated*	4.1	1309	73.153	73.154
	Aluminum powder, *phyrophoric See* **Pyrophoric metals**				
	Aluminum, *powder, uncoated, non-pyrophoric*	4.3	1396	73.153	73.154
	Aluminum resinate	4.1	2715	73.153	73.154
	Aluminum silicon, *powder, uncoated*	4.3	1398	73.153	73.154
	Aluminum tributyl	4.2	2003	73.118	73.119
	Aluminum triethyl	4.2	1102	73.118	73.119
	Aluminum trimethyl	4.2	1103	73.118	73.119
	2-Amino—4-chlorophenol	6.1	2673	73.345	73.346
	N—Aminoethylpiperazine	8	2815	73.244	73.245
	Aminopyridines (o-,m-,p-)	6.1	2671	73.364	73.365
S	**Ammonia, anhydrous,** *liquefied, and ammonia solutions below S.G. 0.88 at 15 degrees C. ammonia liquid and ammonia soluton in water containing over 50% of ammonia*	2.4	1005	73.306	73.304 73.314 73.315
	Ammonia, *solutions below S.G. 0.88 at 15 degrees C. containing more than 35% and not above 50% ammonia*	2.4	2073	73.306	73.304 73.314 73.315
	Ammonia, *solutions having a density (specific gravity) between 0.880 and 0.957 at 15 degree C. in water, containing more than 10% and not more than 35% by weight ammonia.*	8	2672	73.244	73.245
	Ammonia arsenate	6.1	1546	73.364	73.365
	Ammonia bifluoride *See* **Ammonium hydrogen fluoride**				
	Ammonium dichromate,	5.1	1439	73.153	73.235
	Ammonium dinitro-o-cresolate	6.1	1843	73.364	73.365
	Ammonium hydrogen fluoride, *solid*	8	1727	73.244	73.245b
	Ammonium hydrogen fluoride, *solution*	8	2817	73.244	73.245
	Ammonium hydrogen sulphate	8	2506	73.244	73.245
	Ammonium metavanadate	6.1	2859	73.364	73.365
S	**Ammonium nitrate,** *containing more than 0.2% by weight of combustible substances, including any organic substance calculated as carbon, to the exclusion of any other added substance.*	1.1	0222	None	73.61
	Ammonium nitrate, *containing not more than 0.2% of combustible material (including organic material calculated as carbon) and free from any other added matter.*	5.1	1942	73.153	73.182
	Ammonium nitrate fertilizer, *containing ammonium nitrate,* **n.o.s.**	5.1	2072	73.153	73.182
S	**Ammonium nitrate fertilizer,** *which is more liable to explode than ammonium nitrate with 0.2 percent combustible substances, including any organic subtance calculated as carbon, to the exclusion of any other added substance.*	1.1	0223	None	73.61

(1) Notes	(2) Commodities	(3) Class	(4) Identification Number	(5) Packaging (a) Exemptions	(5) Packaging (b) Specific Requirements
	Ammonium nitrate fertilizers				
	(1) Uniform non-segregating mixtures of ammonium nitrate with added matter which is inorganic and chemically inert towards ammonium nitrate, containing not less than 90% of ammonium nitrate and not more than 0.2% of combustible material (including organic material calculated as carbon), or containing less than 90% but more than 70% of ammonium nitrate and not more than 0.4% of total combustible material.	5.1	2067	73.153	73.182
	(2) Uniform non-segregating mixtures of ammonium nitrate with calcium carbonate and/or dolomite, containing more than 80% but less than 90% of ammonium nitrate and not more than 0.4% of total combustible material.	5.1	2068	73.153	73.182
	(3) Uniform non-segregating mixtures of ammonium nitrate/ammonium sulphate, containing more than 45% but not more than 70% of ammonium nitrate and containing not more than 0.4% of total combustible material.	5.1	2069	73.153	73.182
	(4) Uniform non-segregating mixtures of nitrogen/phosphate or nitrogen/potash types or complete fertilizers of nitrogen/phosphate/potash type, containing more than 70% but less than 90% of ammonium nitrate and not more than 0.4% of total combustible material.	5.1	2070	73.153	73.182
	Ammonium nitrate fertilizers, *Type B Uniform non-segregating mixtures of nitrogen/phosphate or nitrogen/potash types or complete fertilizers of nitrogen/phosphate/potash types, containing not more than 70% of ammonium nitrate and not more than 0.4% of total added combustible material or containing not more than 45% of ammonium nitrate with unrestricted combustible material.*	9	2071	73.386	None
	Ammonium nitrate	5.1	2426	None	73.154(a)(17)
	Ammonium perchlorate	5.1	1442	73.153	73.239a
	Ammonium persulphate	5.1	1444	73.153	73.154
S	**Ammonium picrate,** *dry or containing by weight, less than 10% water*	1.1	0004	None	73.61
	Ammonium picrate, *wetted with not less than 10% water*	4.1	1310	73.192	
	Ammonium polysulphide, solution	8	2818	73.244	73.245
	Ammonium polyvanadate	6.1	2861	73.364	73.365
	Ammonium sulphide, solution	8	2683	73.244	73.245
	Ammunition, illuminating, *with or without burster, expelling charge or propelling charge.*	1.4	0297	None	73.101
S	**Ammunition, illuminating,** *with or without burster, expelling charge or propelling charge.*	1.2	0171	None	73.54
	Ammunition, illuminating, *with or without burster, expelling charge or propelling charge.*	1.3	0254	None	73.54
	Ammunition, incendiary, *liquid or gel, with burster, expelling charge or propelling charge.*	1.3	0247	None	73.54
	Ammunition, incendiary, *(other than water-activated ammunition), without white phosphorus or phosphides, with or without burster, expelling charge or propelling charge.*	1.4	0300	None	73.101
S	**Ammunition, incendiary,** *(other than water-activated ammunition), without white phosphorus or phosphides, with or without burster, expelling charge or propelling charge.*	1.2	0009	None	73.54
	Ammunition, incendiary, *(other than water-activated ammunition), without white phosphorus or phosphides, with or without burster, expelling charge or propelling charge.*	1.3	0010	None	73.54
S	**Ammunition, incendiary,** *white phosphorus, with burster, expelling charge or propelling charge.*	1.2	0243	None	73.54
	Ammunition, incendiary, *white phosphorus, with burster, expelling charge or propelling charge.*	1.3	0244	None	73.54
	Ammunition, practice	1.4	0362	None	73.101
	Ammunition, proof	1.4	0363	None	73.101
S	**Ammunition, smoke** *(other than water-activated ammunition), (without white phosphorus or phosphides), with or without burster, expelling charge or propelling charge.*	1.2	0015	None	73.54
	Ammunition, smoke *(other than water-activated ammunition), (without white phosphorus or phosphides), with or without burster, expelling charge or propelling charge.*	1.3	0016	None	73.54
	Ammunition, smoke *(other than water-activated ammunition), (without white phosphorus or phosphides), with or without burster, expelling charge or propelling charge.*	1.4	0303	None	73.101
S	**Ammunition, smoke, white phophorus** *(other than water-activated ammunition), with burster, expelling charge or propelling charge.*	1.2	0245	None	73.54
	Ammunition, smoke, white phophorus *(other than water-activated ammunition), with burster, expelling charge or propelling charge.*	1.3	0246	None	73.54
S	**Ammunition, tear producing, non-explosive,** *with neither burster nor expelling charge, non-fuzed.*	6.1	2017	None	73.328 73.330 73.350
S	**Ammunition, tear producing,** *with burster, expelling charge or propelling charge.*	1.2	0018	None	73.54
	Ammunition, tear producing, *with burster, expelling charge or propelling charge.*	1.3	0019	None	73.54
	Ammunition, tear producing, *with burster, expelling charge or propelling charge.*	1.4	0301	None	73.101
S	**Ammunition, (toxic), non-explosive,** *with neither burster nor expelling charge, non-fuzed.*	6.1	2016	None	73.328 73.330 73.350
S	**Ammunition, toxic** *(other than water-activated ammunition) with burster, expelling charge or propelling charge.*	1.2	0020	None	73.54
	Ammunition, toxic *(other than water-activated ammunition) with burster, expelling charge or propelling charge.*	1.3	0021	None	73.54
	Amyl acetates	3.2	1104	73.118	73.119
		3.3	1104	73.118a	None
	Amyl acid phosphate	8	2819	73.244	73.245b
	Amyl alcohols	3.2	1105	73.118	73.119
		3.3	1105	73.118a	None
	Amylamine	3.2	1106	73.118	73.119
	Amyl butyrates	3.3	2620	73.118	None
	Amyl chloride	3.2	1107	73.118	73.119
	n-Amylene	3.1	1108	73.118	73.119
	Amyl formates	3.3	1109	73.118a	None
	Amyl hydride *See* **Pentane**				
	Amyl mercaptan	3.2	1111	None	73.141
	Amyl methyl ketone	3.3	1110	73.118a	None
	Amyl nitrate	3.3	1112	73.118a	None
	Amyl nitrite	3.1	1113	73.118	73.119
	tert-Amyl peroxy-2-ethylhexanoate, *technically pure*	5.2	2898	73.153	73.221

(1) Notes	(2) Commodities	(3) Class	(4) Identification Number	(5) Packaging (a) Exemptions	(5) Packaging (b) Specific Requirements
	tert-Amyl peroxyneodecanoate, *not more than 75 per cent with phlegmatiser*	5.2	2891	73.153	73.221
	tert-Amyl peroxypivalate, *not more than 77 per cent in solution*	5.2	2957	73.153	73.221
	Amyl trichlorosilane	8	1728	None	73.280
	Aniline	6.1	1547	None	73.347
	Aniline oil *See* **Aniline**				
	Anisole	3.3	2222	73.118a	None
	Anisoyl chloride	8	1729	73.244	73.279
	Anti-freeze *See* **Flammable liquid preparations, n.o.s.**				
	Antimony chloride *See* **Antimony trichloride,** *liquid or solid*				
	Antimony compounds, *(inorganic)* **n.o.s.**	6.1	1549	73.244	73.245 73.245b
	Antimony pentachloride, *liquid*	8	1730	None	73.247
	Antimony pentachloride, *solutions*	8	1731	73.244	73.245
	Antimony pentafluoride	8	1732	None	73.246
	Antimony trichloride, *liquid*	8	1733	73.244	73.245
	Antimony trichloride, *solid*	8	1733	73.244	73.245b
	Argon, *compressed*	2.2	1006	73.306	73.302
	Argon, *liquid*	2.2	1951	None	73.304 73.314
S	**Arsenic acid,** *liquid*	6.1	1553	73.345	73.348
	Arsenic acid, *solid*	6.1	1554	73.364	73.366
	Arsenical dust	6.1	1562	73.364	73.368
	Arsenical flue dust. *See* **Arsenical dust**				
	Arsenical pesticides, *liquid flammable, toxic,* **n.o.s.** *flash point less than 23°C*	3.2	2760	73.118	73.119
	Arsenical pesticides, *liquid, toxic, flammable,* **n.o.s.** *flash point not less than 23°C*	6.1	2993	73.345	73.346
	Arsenical pesticides, *liquid, toxic,* **n.o.s.**	6.1	2994	73.345	73.346
	Arsenical pesticides, *solid, toxic,* **n.o.s.**	6.1	2759	73.364	73.365
	Arsenic bromide	6.1	1555	73.364	73.365
	Arsenic chloride. *See* **Arsenic trichloride**				
	Arsenic compounds, *(liquid),* **n.o.s.**	6.1	1556	73.345	73.346
	Arsenic compounds, *(solid),* **n.o.s.**	6.1	1557	73.364	73.367
	Arsenic, *metallic*	6.1	1558	73.364	73.367
	Arsenic pentoxide	6.1	1559	73.364	73.365
	Arsenic suphides, *(solid),* **n.o.s.** *See* **Arsenic compounds,** *(solid),* **n.o.s.**				
	Arsenic trichloride	6.1	1560	73.345	73.346
	Arsenic trioxide	6.1	1561	73.364	73.366 73.368
S	**Arsine**	2.3	2188	None	73.328
	Articles, explosive, n.o.s.	1.4	0350	None	73.102
	Articles, explosive, n.o.s.	1.4	0351	None	73.102
	Articles, explosive, n.o.s.	1.4	0352	None	73.102
	Articles, explosive, n.o.s.	1.4	0353	None	73.102
	Articles, explosive, n.o.s.	1.4	0349	None	73.102
S	**Articles, explosive, n.o.s.**	1.1	0354	None	73.61
S	**Articles, explosive, n.o.s.**	1.2	0355	None	73.91
	Articles, explosive, n.o.s.	1.3	0356	None	73.91
S	**Articles,** *phyrophoric*	1.2	0380	None	73.91
	Asbestos, blue	9	2212	73.386	None
	Asbestos, white	9	2590	73.386	None
	Asphalt cut-backs. *See* **Cut-backs,** *asphalt or bitumen*				
	Azodiisobutyronitrile	4.1	2952	73.153	73.154
	2,2-Azodi-(2,4-dimethyl-4-methoxyvaleronitrile)	4.1	2955	73.153	73.154
	2,2-Azodi-(2,4-dimethylvaleronitrile)	4.1	2953	73.153	73.154
	Azodi-(1,1-hexahydrobenzonitrile)	4.1	2954	73.153	73.154
	Bags, *(empty and unwashed), having contained Potassium nitrate or sodium nitrate*	4.1	1359	None	73.155
	Barium alloys, *non-pyrophoric*	4.3	1399	73.153	73.154
S	**Barium alloys** *pyrophoric*	4.2	1854	73.153	73.154
	Barium azide, *containing at least 50% water or alcohol*	4.1	1571	None	73.239
S	**Barium azide,** *dry or containing, by weight, less than 50% water or alcohol*	1.1	0224	None	73.73
	Barium bromate	5.1	2719	73.153	73.154
	Barium chlorate	5.1	1445	73.153	73.163
	Barium compounds, n.o.s.	6.1	1564	73.364	73.365
S	**Barium cyanide**	6.1	1565	73.370	73.370
	Barium hypochlorite *with more than 22 per cent available chlorine*	5.1	2741	73.153	73.154
	Barium	4.3	1400	73.153	73.154
	Barium nitrate	5.1	1446	73.153	73.182
	Barium perchlorate	5.1	1447	73.153	73.154
	Barium permanganate	5.1	1448	73.153	73.154
	Barium peroxide	5.1	1449	73.153	73.156
	Batteries, *wet, filled with acid, electric, storage*	8	2794	73.260	73.260
	Batteries, *wet, filled with alkali, electric storage*	8	2795	73.260	73.260
	Batteries, *wet non-spillable, electric storage*	8	2800	73.260	73.260
	Battery fluid, *acid*	8	2796	None	73.257 73.258 73.259
	Battery fluid, *alkali*	8	2797	None	73.249 73.257 73.258 73.259
	Benzene	3.2	1114	73.118	73.119
	Benzene, 1,3-disulphohydrazide, *not more than 52 per cent as a paste*	4.1	2971	73.153	73.154

(1) Notes	(2) Commodities	(3) Class	(4) Identification Number	(5) Packaging (a) Exemptions	(5) Packaging (b) Specific Requirements
	Benzene suphohydrazide	4.1	2970	73.153	73.154
	Benzene sulphonyl chloride	8	2225	73.244	73.245
	Benzidine	6.1	1885	73.364	73.365
	Benzine	3.1	1115	73.118	73.119
		3.2	1115	73.118	73.119
		3.3	1115	73.118a	None
	Benzoic derivative pesticides, *liquid, flammable, toxic,* **n.o.s.** *flash point less than 23°C*	3.2	2770	73.118	73.119
	Benzoic derivative pesticides, *liquid, toxic, flammable,* **n.o.s.** *flash point not less than 23°C*	6.1	3003	73.345	73.346
	Benzoic derivative pesticides, *liquid toxic,* **n.o.s.**	6.1	3004	73.345	73.346
	Benzoic derivative pesticides, *solid, toxic* **n.o.s.**	6.1	2769	73.364	73.365
S	**Benzonitrile**	6.1	2224	73.118a	None
	Benzoquinone	6.1	2587	73.364	73.365
	Benzotrichloride	8	2226	73.244	73.245
					73.245a
	Benzotrifluoride	3.2	2338	73.118	73.119
	Benzoyl chloride,	8	1736	73.244	73.247
	Benzoyl peroxide, *in a concentration of more than 77% but less than 95% with water*	5.2	2088	None	73.157
					73.158
	Benzoyl peroxide, *in a concentration of not more than 72% as a paste*	5.2	2087	73.153	73.154
	Benzoyl peroxide, *in a concentration of not more than 77% with water*	5.2	2090	None	73.157
	Benzoyl peroxide, *in a concentration from 30% to maximum 52% with inert solid*	5.2	2089	73.153	73.154
	Benzoyl peroxide, *technical pure or in a concentration of more than 52% with inert solid*	5.2	2085	None	73.157
					73.158
	Benzyl bromide	6.1	1737	None	73.281
	Benzyl chloride,	6.1	1738	73.244	73.295
	Benzyl chloroformate	8	1739	None	73.288
	Benzyl dimethylamine	8	2619	73.244	73.245
	Benzylidene chloride	6.1	1886	73.345	73.346
	Benzyl iodide	6.1	2653	73.364	73.365
	Beryllium compounds, n.o.s.	6.1	1566	73.364	73.365
	Beryllium, *metal powder*	6.1	1567	73.364	73.365
	Beryllium nitrate	5.1	2464	73.153	73.182
	Bifluorides, n.o.s.	8	1740	73.244	73.245b
	Bipyridium pesticides, *liquid, flammable, toxic,* **n.o.s.***flash point not less than 23°C*	3.2	2782	73.118	73.119
	Bipyridium pesticides, *liquid, toxic, flammable,* **n.o.s.***flash point not less than 23°C*	6.1	3015	73.345	73.346
	Bipyridium pesticides, *liquid, toxic,* **n.o.s.**	6.1	3016	73.345	73.346
	Bipyridium pesticides, *solid, toxic,* **n.o.s.**	6.1	2781	73.364	73.365
	Bisulphites, *inorganic aqueous solutions,* **n.o.s.**	8	2693	73.244	73.245
	Bis-(4-tert-butyl cyclohexyl) perdicarbonate, *technical pure*	5.2	2154	73.153	73.154
	2,2-Bis-(tert-butylperoxy) butane, *maximum concentration 55% in solution*	5.2	2111	73.153	73.221
	1,1-Bis-(tert-butylperoxy) cyclohexane, *maximum concentration 77% in solution*	5.2	2180	73.153	73.221
	1,2-Bis-(tert-butylperoxy) cyclohexane, *maximum concentration 77% in solution*	5.2	2181	73.153	73.221
	1,1-Bis-(tert-butylperoxy) cyclohexane, *technical pure*	5.2	2179	73.153	73.221
	1,4-Di-(2-tert-butylperoxy isopropyl) benzene, *technically pure or* **1,4-di-(2-tert-butylperoxy isopropyl—) benzene,** *more than 40% with inert solid or* **1,3-di-(2-tert-butylperoxy isopropyl) benzene,** *technically pure or* **1,3-di-(2-tert-butylperoxy isopropyl) benzene** *more than 40% with inert solid or* **1,4-di(2-tert-butylperoxy isopropyl) benzene** *and* **1,3-di(2-tert-butylperoxy isopropyl) benzene mixtures,** *technically pure or* **1,4-di(2-tert-butylperoxy isopropyl) benzene** *and* **1,3-di(2-tert-butylperoxy isopropyl) benzene mixtures,** *more than 40% with inert solid*	5.2	2112	73.153	73.154
	1,1-Bis-(tert-butylperoxy) -3,3,5-trimethyl cyclohexane, *technical pure*	5.2	2145	73.153	73.221
	1,1-Bis-(tert-butylperoxy) -3,3,5-trimethyl cyclohexane, *maximum concentration 57% in solvent*	5.2	2146	73.153	73.221
	1,1-Bis-(tert-butylperoxy) -3,3,5-trimethyl cyclohexane, *maximum concentration 58% with inert solid*	5.2	2147	73.153	73.154
	2,2-Bis-(4,4-di-tert-butylperoxy cyclohexyl) propane, *maximum concentration 42% with inert solid*	5.2	2168	73.153	73.154
	Bis-(1-hydroxy cyclohexyl) peroxide, *technical pure*	5.2	2148	73.153	73.154
	Bis-(2-methylbenzoyl) peroxide, *with at least 15% water*	5.2	2593	73.153	73.154
	Bis-(3,5,5-trimethyl-1,2-dioxolanyl-3) peroxide, *as a paste with at least 50% phlegmatizer*	5.2	2597	73.153	73.154
S	**Black powder,** *compressed*	1.1	0028	None	73.60
S	**Black powder,** *granular or as meal*	1.1	0027	None	73.60
	Blasting cap assemblies, *non-electric*	1.4	0361	None	73.103
S	**Blasting cap assemblies,** *non-electric*	1.1	0360	None	73.66
	Blasting caps, *electric*	1.4	0255	None	73.103
S	**Blasting caps,** *electric*	1.1	0030	None	73.66
	Blasting caps, *non- electric*	1.4	0267	None	73.103
S	**Blasting caps,** *non-electric*	1.1	0029	None	73.66
	Bleaching powder. *See* **Calcium hypochlorite mixtures,** *dry, containing 39% or less, but more than 10% available chlorine*				
	Blue asbestos. *See* **Asbestos, blue**				
S	**Bombs,** *photo-flash*	1.1	0038	None	73.54
S	**Bombs,** *photo-flash*	1.1	0037	None	73.54
S	**Bombs,** *photo-flash*	1.2	0039	None	73.54
	Bombs, *photo-flash*	1.3	0299	None	73.54
	Bombs, smoke, *containing a corrosive liquid, non-explosive, without initiating device*	8	2028	73.244	73.245
					73.245a
S	**Bombs,** *with bursting charge*	1.1	0034	None	73.54
S	**Bombs,** *with bursting charge*	1.2	0035	None	73.54
S	**Bombs,** *with bursting charge*	1.1	0033	None	73.54
S	**Bombs,** *with bursting charge*	1.2	0291	None	73.54
S	**Bombs,** *with flammable liquid, with bursting charge*	1.1	0399	None	73.54
S	**Bombs,** *with flammable liquid, with bursting charge*	1.2	0400	None	73.54

(1) Notes	(2) Commodities	(3) Class	(4) Identification Number	(5) Packaging (a) Exemptions	(5) Packaging (b) Specific Requirements
S	**Boosters,** *with detonator*	1.1	0225	None	73.54
S	**Boosters,** *with detonator*	1.2	0268	None	73.54
S	**Boosters,** *without detonator*	1.1	0042	None	73.54
S	**Boosters,** *without detonator*	1.2	0283	None	73.54
	Borate and chlorate, *mixtures*	5.1	1458	73.153	73.229
	Borneol	4.1	1312	73.153	73.154
	Boron tribromide	8	2692	None	73.251
S	**Boron trichloride**	2.3	1741	None	73.251
S	**Boron trifluoride**	2.3	1008	None	73.302
	Boron trifluoride acetic acid complex	8	1742	73.244	73.247
	Boron trifluoride diethyl etherate	8	2604	73.244	73.245 73.245a
	Boron trifluoride dihydrate	8	2851	73.244	73.245
	Boron trifluoride dimethyl etherate	4.3	2965	73.153	73.154
	Boron trifluoride propionic acid complex	8	1743	73.244	73.245b
	Box toe gum *See* **Nitrocellulose**				
	Brake fluid, *hydraulic*	3.2	1118	73.118	73.119
	Bromates, *(inorganic),* **n.o.s.**	5.1	1450	73.153	73.154
S	**Bromine,** *(and solutions)*	8	1744	None	73.252
S	**Bromine Chloride**	2.3	2901	None	73.302
S	**Bromine pentafluoride**	5.1	1745	None	73.246
S	**Bromine trifluoride**	5.1	1746	None	73.246
	Bromoacetic acid, *solid*	8	1938	73.244	73.245b
	Bromoacetic acid, *solution*	8	1938	73.244	73.245
S	**Bromoacetone**	6.1	1569	None	73.329
	Bromoacetyl bromide	8	2513	73.244	73.245 73.245a
	Bromobenzene	3.3	2514	73.118a	None
S	**Bromobenzyl cyanide**	6.1	1694	73.345	73.346
	2-Bromobutane	3.2	2339	73.118	73.119
	Bromochloromethane	9	1887	73.386	None
	2-Bromoethyl ethyl ether	3.2	2340	73.118	73.119
	1-Bromo-3-methylbutane	3.2	2341	73.118	73.119
	Bromomethylpropanes	3.2	2342	73.118	73.119
	Bromomethylpropanes	3.3	2342	73.118a	None
	2-Bromopentane	3.2	2343	73.118	73.119
	Bromopropanes	3.2	2344	73.118	73.119
	Bromopropanes	3.3	2344	73.118a	None
	3-Bromopropyne	3.2	2345	73.118	73.119
	Bromotrifluoroethylene	2.1	2419	73.306 73.307	73.302 73.304
	Bromotrifluoromethane	2.2	1009	73.306	73.304 73.314
	Brucine	6.1	1570	73.364	73.365
S	**Bursters,** *explosive*	1.1	0043	None	73.54
S	**Butadiene,** *inhibited*	2.1	1010	73.306	73.304 73.314 73.315
	Butanedione	3.2	2346	73.118	73.119
S	**Butane** *or* **butane mixtures**	2.1	1011	73.306	73.304 73.314 73.315
	Butanols	3.2	1120	73.118	73.119
		3.3	1120	73.118a	None
	Butoxyl	3.3	2708	73.118a	None
	sec-butyl acetate	3.2	1124	73.118	73.119
	Butyl Acetates	3.2	1123	73.118	73.119
	Butyl Acid Phosphate *See* **Acid Butyl Phosphate**				
	Butylacrylate, *inhibited*	3.3	2348	73.118a	None
	n-Butylamine	3.2	1125	73.118	73.119
	N-Butylaniline	6.1	2738	73.345	73.346
	Butyl benzenes	3.3	2709	73.118a	None
	n-Butyl-4,4-bis-(tert-butyl-peroxy) valerate, *maximum concentration 52% with inert solid*	5.2	2141	73.153	73.154
	n-Butyl-4,4-bis-(tert-butyl-peroxy) valerate, *technical pure*	5.2	2140	73.153	73.221
	n-Butyl bromide	3.3	1126	73.118a	None
	n-Butyl chloroformate	6.1	2743	73.345	73.346
	tert-Butyl cumene peroxide. *See* **tert-Butyl cumyl peroxide**				
	tert-Butyl cumyl peroxide, *technical pure*	5.2	2091	73.153	73.221
	tert-Butyl diperoxyphthalate. *See* **tert-Butyl diperphthalate**				
	tert-Butyl diperphthalate, *maximum concentration 55% as a paste*	5.2	2108	73.153	73.154
	tert-Butyl diperphthalate, *maximum concentration 55% in solution*	5.2	2107	73.153	73.221
	tert-Butyl diperphthalate, *technical pure*	5.2	2106	73.153	73.154
	n-Butyl-4, 4-di(tert-Butylperoxy), valerate, *not more than 52 per cent with inert solid*	5.2	2141	73.153	73.154
	n-Butyl-4, 4-di(tert-Butylperoxy), valerate, *technically pure*	5.2	2140	73.153	73.154
S	**Butylene**	2.1	1012	73.306	73.302 73.304 73.305
	Butyl ether. *See* **dibutyl ether**				
	n-Butyl formate	3.2	1128	73.118	73.119
	tert-Butyl hydroperoxide, *in a concentration over 72% to maximum 90% with water*	5.2	2094	73.153	73.221
	tert-Butyl hydroperoxide, *maximum concentration 80% in di-tert-butyl peroxide and/or solvent*	5.2	2092	73.153	73.221

(1) Notes	(2) Commodities	(3) Class	(4) Identification Number	(5) Packaging (a) Exemptions	(5) Packaging (b) Specific Requirements
	tert-Butyl hydroperoxide, *maximum concentration 72% with water*	5.2	2093	73.153	73.221
	N,n-Butyl *imidazole*	6.1	2690	73.345	73.346
	tert-Butyl isocyanate	3.2	2484	73.118	73.119
	n-Butyl isocyanate	3.2	2485	73.118	73.119
	n-Butyl methacrylate	3.3	2227	73.118a	None
	Butyl methyl ether	3.2	2350	73.118	73.119
	tert-Butyl monoperoxymaleate, *not more than 55 per cent as a paste*	5.2	2101	73.153	73.154
	tert-Butyl monoperoxymaleate, *not more than 55 per cent in solution*	5.2	2100	73.153	73.221
	tert-Butyl monoperoxymaleate, *technically pure*	5.2	2099	73.153	73.154
	Butyl mercaptan	3.2	2347	None	73.141
	tert-Butyl monoperoxyphthalate. *See* **tert-Butyl monoperphtalate**				
	tert-Butyl monoperphthalate, *technical pure*	5.2	2105	73.153	73.154
	Butyl nitrite	3.2	2351	73.118	73.119
	tert-Butyl peracetate, *in a concentration of more than 52% to a maximum concentration of 76% in solution*	5.2	2095	73.153	73.221
	tert-Butyl peracetate, *maximum concentration 52% in solution*	5.2	2096	73.153	73.221
	tert-Butyl perbenzoate, *maximum concentration 75% in solution*	5.2	2098	73.153	73.221
	tert-Butyl perbenzoate, *technical pure or in a concentration of more than 75% in solution*	5.2	2097	73.153	73.221
	tert-Butyl percrotonate, *maximum concentration 76% in solution*	5.2	2183	73.153	73.221
	n-Butyl perdicarbonate, *in a concentration of more than 27% to a maximum concentration of 52% in solution*	5.2	2169	73.153	73.221
	n-Butyl perdicarbonate, *maximum concentration 27% in solution*	5.2	2170	73.153	73.221
	tert-Butyl perdiethylacetate, *(in a maximum concentration of 33%), with* **tert-butyl perbenzoate** *(in a maximum concentration of 33%), and solvent*	5.2	2551	73.153	73.221
	tert-Butyl perdiethylacetate, *technical pure*	5.2	2144	73.153	73.221
	tert-Butyl per (2-ethyl) hexanoate, *technical pure*	5.2	2143	73.153	73.221
	tert-Butyl perisobutyrate, *in a concentration of more than 52% to a maximum concentration of 77% in solution*	5.2	2142	73.153	73.221
	tert-Butyl perisobutyrate, *maximum concentration 52% in solution*	5.2	2562	73.153	73.221
	tert-Butyl permaleate, *maximum concentration 55% as a paste*	5.2	2101	73.153	73.154
	tert-Butyl permaleate, *maximum concentration 55% in solution*	5.2	2100	73.153	73.221
	tert-Butyl permaleate, *technical pure*	5.2	2099	73.153	73.154
	tert-Butyl per-neodecanoate, *maximum concentration 77% in solution*	5.2	2177	73.153	73.221
	tert-Butyl per-neodecanoate, *technical pure*	5.2	2594	73.153	73.221
	tert-Butyl peroxide, *technical pure*	5.2	2102	73.153	73.221
	tert-Butyl peroxyacetate. *See* **tert-Butyl peracetate**				
	tert-Butyl peroxybenzoate. *See* **tert-Butyl perbenzoate**				
	tert-Butyl peroxycrotonate. *See* **tert-Butyl percrotonate**				
	n-Butyl peroxydicarbonate. *See* **n-Butyl perdicarbonate**				
	tert-Butyl peroxydiethylacetate. *See* **tert-Butyl perdiethylacetate**				
	tert-Butyl perdiethylacetate with tert-butyl peroxybenzoate. *See* **tert-Butyl perdiethylacetate with tert-butyl perbenzoate**				
	tert-Butyl peroxydiethylacetate, *technically pure*	5.2	2144	73.153	73.221
	tert-Butyl peroxy-2-ethylehexanoate, *not more than 50 per cent with phlegmatizer*	5.2	2888	73.153	73.221
	tert-Butyl peroxy-2-ethylhexanoate, *technically pure*	5.2	2143	73.153	73.221
	tert-Butyl peroxy-(2-ethyl) hexanoate. *See* **tert-Butyl per-(2-ethyl)hexanoate**				
	tert-Butyl peroxyisobutyrate. *See* **tert-Butyl perisobutyrate**				
	tert-Butyl peroxyisobutyrate, *more than 52 per cent but not more than 77 per cent in solution*	5.2	2142	73.153	73.221
	tert-Butyl peroxy isopropyl carbonate, *technical pure*	5.2	2103	73.153	73.221
	tert-Butyl peroxymaleate. *See* **tert-Butyl permaleate**				
	tert-Butyl peroxy-neodecanoate. *See* **tert-Butyl per-neodecanoate**				
	3-tert-Butyl peroxy-3-phenyl phthalide, *technical pure*	5.2	2596	73.153	73.154
	tert-Butyl peroxypivalate. *See* **tert-Butyl perpivalate**				
	tert-Butyl peroxy-3,5,5-trimethyl hexanoate, *technical pure*	5.2	2104	73.153	73.221
	tert-Butyl perpivalate, *maximum concentration 77% in solution*	5.2	2110	73.153	73.221
	Butyl phosphoric acid. *See* **Acid butyl phosphate**				
	Butyl propionate	3.3	1914	73.118a	None
	Butyl trichlorosilane	8	1747	None	73.280
	5-tert-Butyl1-2,4,6-trinitro-m-xylene *or* **Musk xylene**	4.1	2956	73.153	73.154
	Butyl vinyl ether	3.2	2352	73.118	73.119
	1-Butyne *See* **Ethyl acetylene,** *inhibited*				
	1,4 Butynediol	4.1	2716	73.153	73.154
	Butyraldehyde	3.2	1129	73.118	73.119
	Butyraldoxime	3.3	2840	72.118a	None
	Butyric acid	8	2820	73.244	73.245
	Butyric Anhydride	8	2739	73.244	73.245
	Butyrone	3.3	2710	73.118a	None
	Butyronitrile	3.2	2411	73.118	73.119
	Butyryl chloride	3.2	2353	73.118	73.119
	Cacodylic acid	6.1	1572	73.364	73.365
	Cadmium compounds, *except Cadmium selenide and Cadmium sulphide*	6.1	2570	73.364	73.365
	Caesium hydroxide	8	2682	73.244	73.245b
	Caesium hydroxide solution	8	2681	73.244	73.245
	Caesium, *metal*	4.3	1407	None	73.206
	Caesium nitrate	5.1	1451	73.153	73.154
	Caesium, *powdered.* *See* **Pyrophoric metals**				
	Calcium arsenate	6.1	1573	73.364	73.367 73.368
	Calcium arsenate and arsenite, *solid mixtures*	6.1	1574	73.364	73.365
	Calcium carbide	4.3	1402	None	73.178
	Calcium chlorate	5.1	1452	73.153	73.163

(1) Notes	(2) Commodities	(3) Class	(4) Identification Number	(5) Packaging (a) Exemptions	(5) Packaging (b) Specific Requirements
	Calcium chlorate, *aqueous solution*	5.1	2429	None	73.245
	Calcium chlorite	5.1	1453	None	73.160
	Calcium cyanamide, *containing more than 0.1% of calcium carbide*	4.3	1403	73.153	73.154
S	**Calcium cyanide**	6.1	1575	73.370	73.370
	Calcium dithionite	4.2	1923	73.153	73.154
	Calcium hydride	4.3	1404	73.153	73.154
	Calcium hypochlorite, *dry including mixtures containing more than 39% available chlorine (8.8% available oxygen)*	5.1	1748	73.153	73.217
	Calcium hypochlorite *hydrated or* **calcium hypochlorite,** *hydrated, mixtures with not less than 5.5% but not more than 10% water*	5.1	2880	73.153	73.217
	Calcium hypochlorite mixtures, *dry containing 39% or less, but more than 10% available chlorine*	5.1	2208	73.153	73.154
	Calcium, *metal and alloys, non-pyrophoric*	4.3	1401	73.153	73.154
	Calcium nitrate	5.1	1454	73.153	73.182
	Calcium oxide	8	1910	73.244	73.245b
	Calcium perchlorate	5.1	1455	73.153	73.154
	Calcium permanganate	5.1	1456	73.153	73.154
	Calcium peroxide	5.1	1457	73.153	73.156
S	**Calcium phosphide**	4.3	1360	None	73.161
	Calcium, *pyrophoric or* **calcium alloy,** *pyrophoric*	4.2	1855	73.153	73.154
	Calcium resinate, *fused*	4.1	1314	None	73.166
	Calcium resinate, *technical pure*	4.1	1313	None	73.166
	Calcium silicide	4.3	1405	73.153	73.154
	Calcium silicon	4.3	1406	73.153	73.178
	Camphor oil	3.3	1130	73.118a	None
	Capryloyl peroxide. *See* **n-Octanoyl peroxide**				
	Caps, blasting *See* **Blasting, caps**				
	Carbamate pesticides, *liquid, flammable, toxic,* **n.o.s.** *flash point less than 23°C*	3.2	2758	73.118	73.119
	Carbamate pesticides, *liquid, toxic, flammable,* **n.o.s.** *flash point not less than 23°C*	6.1	2991	73.345	73.346
	Carbamate pesticides, *liquid toxic,* **n.o.s.**	6.1	2992	73.345	73.346
	Carbamate pesticides, *solid, toxic,* **n.o.s.**	6.1	2757	73.364	73.365
	Carbolic acid. *See* **Phenol**				
	Carbon, activated	4.2	1362	73.162	73.162
	Carbon bisulphide. *See* **Carbon disulphide**				
	Carbon dioxide	2.2	1013	73.306 73.307	73.302 73.304 73.314 73.315
	Carbon dioxide, *refrigerated liquid*	2.2	2187	73.306 73.307	73.304 73.314 73.315
S	**Carbon dioxide and ethylene oxide,** *mixtures with more than 6% ethylene oxide*	2.1	1041	73.306	73.302 73.304 73.305
S	**Carbon dioxide and ethylene oxide,** *mixtures with not more than 6% ethylene oxide*	2.1	1952	73.306	73.302 73.304 73.305
	Carbon dioxide and nitrous oxide, *mixtures*	2.2	1015	73.306	73.304
	Carbon dioxide and oxygen, *mixtures*	2.2	1014	73.306	73.304
S	**Carbon disulphide**	3.1	1131	None	73.121
S	**Carbon monoxide**	2.1	1016	73.306	73.302
S	**Carbon monoxide and hydrogen,** *mixture*	2.1	2600	73.306	73.302
	Carbon, non-activated, *of animal or vegetable origin*	4.2	1361	73.153	73.154 73.162
	Carbon paper. *See* **Paper,** *treated with unsaturated oils, incompletely dried*				
	Carbon remover, *liquid*	3.2	1132	73.118	73.119
	Carbon sulphide. *See* **Carbon disulphide**				
	Carbonyl chloride. *See* **Phosgene**				
S	**Carbonyl fluoride**	2.3	2417	None	73.328
S	**Carbonyl sulfide**	2.3	2204	None	73.328
	Cartouche	2.1	2037	73.306	73.302 73.304 73.305
	Cartridge cases, *empty with primer. See* **Cases, cartridges,** *empty, with primer*				
S	**Cartridges,** *flash*	1.1	0049	None	73.54
	Cartridges, *flash*	1.3	0050	None	73.91
	Cartridges for weapons, *blank*	1.4	0338	None	73.101
	Cartridges for weapons, *blank*	1.4	0014	None	73.101
S	**Cartridges for weapons,** *blank*	1.1	0326	None	73.54
S	**Cartridges for weapons,** *blank*	1.2	0413	None	73.54
	Cartridges for weapons, *blank*	1.3	0327	None	73.54
	Cartridges for weapons, *other than blank*	1.4	0012	None	73.101
S	**Cartridges for weapons,** *with bursting charge*	1.1	0006	None	73.54
S	**Cartridges for weapons,** *with bursting charge*	1.2	0321	None	73.54
S	**Cartridges for weapons,** *with bursting charge*	1.1	0005	None	73.54
S	**Cartridges for weapons,** *with bursting charge*	1.2	0007	None	73.54
	Cartridges for weapons, *with bursting charge*	1.4	0348	None	73.101
	Cartridges for weapons, *with bursting charge*	1.4	0412	None	73.101
	Cartridges for weapons, *inert projectile*	1.3	0417	None	73.54
	Cartridges for weapons, *with inert projectile*	1.4	0339	None	73.101
S	**Cartridges for weapons,** *with inert projectile*	1.2	0328	None	73.54
	Cartridges, *oil well*	1.4	0278	None	73.112

(1) Notes	(2) Commodities	(3) Class	(4) Identification Number	(5) Packaging (a) Exemptions	(5) Packaging (b) Specific Requirements
	Cartridges, *oil well*	1.3	0277	None	73.91
	Cartridges, *power device*	1.4	0276	None	73.102
	Cartridges, *power device*	1.4	0323	None	73.102
S	**Cartridge,** *power device*	1.2	0381	None	73.91
	Cartriges, *power device*	1.3	0275	None	73.91
	Cartridges, *safety. See* **Cartridges for weapons,** *other than blank (0012) or* **Cartridges for weapons,** *blank (0014)*				
	Cartridges, *signal*	1.4	0312	None	73.108
	Cartridges, *signal*	1.3	0054	None	73.91
	Cartridges, *signal*	1.4	0405	None	73.108
	Cases, cartridge, *empty, with primer*	1.4	0379	None	73.107
	Cases, cartridges, *empty, with primer*	1.4	0055	None	73.107
	Casinghead gasoline	3.1	1257	73.118	73.119
	Caustic alkali liquid, n.o.s.	8	1719	73.244	73.249
	Caustic potash. *See* **Potassium hydroxide,** *solution*				
	Caustic potash, *solid. See* **Potassium hydroxide,** *solid*				
	Caustic Soda. *See* **Sodium hydroxide**				
	Celluloid, *in blocks, rods, rolls, sheets, tubes, etc. (scrap excluded)*	4.1	2000	73.153	73.154
	Celluloid, *scrap*	4.2	2002	73.153	72.154
	Cerium, *crude*	4.1	1333	73.153	73.154
	Charcoal, activated. *See* **Carbon, activated**				
	Charcoal, non-activated, *of animal or vegetable origin. See* **Carbon, non-activated**				
S	**Charges, demolition**	1.1	0048	None	73.61
S	**Charges, depth**	1.1	0056	None	73.54
S	**Charges, propelling, for cannon**	1.1	0279	None	73.54
S	**Charges, propelling, for cannon**	1.2	0414	None	73.54
	Charges, propelling, for cannon	1.3	0242	None	73.54
S	**Charges, propelling, for rocket motors**	1.1	0271	None	73.54
S	**Charges, propelling, for rocket motors**	1.2	0415	None	73.93
	Charges, propelling, for rocket motors	1.3	0272	None	73.93
S	**Charges, propelling, for rocket motors,** *composite mixture*	1.1	0273	None	73.54
S	**Charges, propelling, for rocket motors,** *composite mixture*	1.2	0416	None	73.93
	Charges, propelling, for rocket motors, *composite mixture*	1.3	0274	None	73.93
S	**Charges, shaped,** *commercial, without detonator*	1.1	0059	None	73.61
	Charges, shaped, *flexible, linear, metal clad*	1.4	0237	None	73.104
S	**Charges, shaped,** *flexible, linear, metal clad*	1.1	0288	None	73.61
S	**Charges, supplementary, explosive**	1.1	0060	None	73.61
	Chloral, *anhydrous, inhibited*	6.1	2075	73.345	73.346
	Chlorate and borate, *mixtures. See* **Borate and chlorate** *mixtures*				
	Chlorate and magnesium chloride, *mixtures*	5.1	1459	73.153	73.229
	Chlorates, *(inorganic),* **n.o.s.**	5.1	1461	73.153	73.163
	Chloric acid, *solution with not more than 10% chloric acid*	5.1	2626	73.153	73.154
	Chlorinated anthracene oil	6.1	2230	73.345	73.346
S	**Chlorine**	2.4	1017	None	73.304 73.314 73.315
S	**Chlorine pentafluoride**	2.3	2548	None	73.246
S	**Chlorine trifluoride**	2.3	1749	None	73.246
	Chlorites, *(inorganic),* **n.o.s.**	5.1	1462	73.153	73.154
S	**Chloroacetaldehyde**	6.1	2232	73.345	73.346
	Chloroacetic acid, *liquid*	8	1750	73.244	73.294
	Chloroacetic acid, *solid*	8	1751	73.244	73.245b
S	**Chloroacetone,** *stabilized*	6.1	1695	None	73.384
	Chloroacetonitrile	6.1	2668	73.345	73.346
S	**Chloroacetophenone**	6.1	1697	None	73.328
	Chloroacetyl chloride	8	1752	None	73.253
	Chloroanilines, *liquid*	6.1	2019	73.345	73.346
	Chloroanilines, *solid*	6.1	2018	73.364	73.365
	Chlorobenzene	3.3	1134	73.118a	None
	Chlorobenzotrifluorides	3.3	2234	72.118a	None
	p-Chlorobenzoyl peroxide, *maximum concentration 52% as a paste*	5.2	2114	73.153	73.154
	p-Chlorobenzoyl peroxide, *maximum concentration 52% in solution*	5.2	2115	73.153	73.221
	p-Chlorobenzoyl peroxide, *maximum concentration 75% with water*	5.2	2113	None	73.157
	Chlorobutanes	3.2	1127	73.118	73.119
	Chlorocresols	6.1	2669	73.345	73.346
	Chlorodifluorobromomethane	2.2	1974	73.306 73.307	73.302 73.304 73.305
S	**Chlorodifluoroethanes** *or* **difluorochloroethanes**	2.1	2517	73.306	73.304 73.314 73.315
	Chlorodifluoromethane	2.2	1018	73.306	73.304 73.314 73.315
	Chlorodifluoromethane and chloropentafluoroethane, *mixture with a fixed boiling point containing about 49% of chlorodifluoromethane*	2.2	1973	73.306 73.307	73.302 73.304 73.305
S	**Chlorodinitrobenzene**	6.1	1577	73.364	73.365
	2-Chloroethanol	6.1	1135	73.345	73.346
	Chloroform	6.1	1888	73.345	73.346
	Chloroformates, n.o.s., *flash point not less than 23°C*	6.1	2742	73.345	73.346

(1) Notes	(2) Commodities	(3) Class	(4) Identification Number	(5) Packaging (a) Exemptions	(5) Packaging (b) Specific Requirements
	Chloromethylchloroformate	6.1	2745	73.345	73.346
	Chloromethyl ethyl ether	3.2	2354	73.118	73.119
	3-Chloro-4-methylphenyl isocyanate	6.1	2236	73.345	73.346
	Chloronitrobenzene, *ortho, liquid*	6.1	1578	73.345	73.346
	Chloronitrobenzenes, *meta or para, solid*	6.1	1578	73.364	73.374
	4-Chloro-o-toluidine hydrochloride	9	1579	None	73.362
	Chloropentafluoroethane	2.2	1020	73.306	73.304
	m-Chloroperoxybenzoic acid, *maximum concentration 86%*	5.2	2755	73.153	73.154
	Chlorophenates, *liquid*	8	2904	73.244	73.245
	Chlorophenates, *solid*	8	2905	73.244	73.245b
	Chlorophenyl trichlorosilane	8	1753	None	73.280
S	**Chloropicrin**	6.1	1580	None	73.357
S	**Chloropicrin and methyl bromide,** *mixtures*	2.3	1581	None	73.353
S	**Chloropicrin and methyl chloride,** *mixtures*	2.3	1582	None	73.329
S	**Chloropicrin mixtures, n.o.s.**	6.1	1583	None	73.357
	Chloroplatinic acid, *solid*	8	2507	73.244	73.245b
	Chloroprene, *inhibited*	3.2	1991	73.118	73.119
	2-Chloropropane	3.1	2356	73.118	73.119
	2-Chloropropene	3.1	2456	None	73.119
	Chloropropionic acid	8	2511	73.244	73.245 73.245a
	2-Chloropyridine	6.1	2822	73.345	73.346
	Chlorosilanes, n.o.s.	8	2987	73.244	73.245
	Chlorosilanes, n.o.s., *flash point less than 23 °C*	3.2	2985	73.118	73.119
	Chlorosilanes, n.o.s., *flash point less than 23 °C but not more than 61 °C*	8	2986	73.244	73.245
	Chlorosilanes, n.o.s., *which in contact with water emit flammable gases*	4.3	2988	73.153	73.154
	Chlorosulphonic acid, *with or without sulphur trioxide*	8	1754	73.244	73.254
	Chlorotetrafluoroethane	2.2	1021	73.306	73.304 73.314
	Chlorotoluenes (o-,m-,p-)	3.3	2238	73.118a	None
	Chlorotrifluoroethane. *See* **Trifluorochloroethane**				
	Chlorotrifluoroethylene. *See* **Trifluorochloroethylene**				
	Chlorotrifluoromethane	2.2	1022	73.306	73.304
	Chlorotrifluoromethane and trifluoromethane, *azeotropic mixture with approximately 60% chlorotrifluoromethane*	2.2	2599	73.306 73.307	73.302 73.304 73.305
	Chromic acid, *solid. See* **Chromium trioxide,** *anhydrous*				
	Chromic acid, *solution*	8	1755	73.244	73.247
	Chromic anhydride *See* **Chromium trioxide,** *anhydrous*				
	Chromic fluoride, *solid*	8	1756	73.244	73.245b
	Chromic fluoride, *solution*	8	1757	73.244	73.245
	Chromium nitrate	5.1	2720	73.153	73.182
	Chromium oxychloride	8	1758	None	73.247
	Chromium trioxide, *anhydrous*	5.1	1463	73.153	73.164
	Chromosulphuric acid	8	2240	73.244	73.245 73.245a
	Chrysotile. *See* **Asbestos,** *white*				
	Cigarettes, *self-lighting*	4.1	1867	73.153	73.154
	Cleaning compound. *See* **Flammable liquid preparations, n.o.s.**				
S	**Coal gas**	2.1	1023	73.306	73.302
	Coal tar distillate	3.2	1136	73.118	73.119
		3.3	1136	73.118a	None
	Coal tar light oil	3.2	1137	73.118	73.119
		3.3	1137	73.118a	None
	Coal tar oil. *See* **Coal tar distillate**				
	coating solution	3.2	1139	73.118	73.132
		3.3	1139	73.118a	None
	Cobalt naphthenates, *powder*	4.1	2001	73.153	73.154
	Cobalt resinate, *precipitated*	4.1	1318	None	73.166
	Cocculus, *solid*	6.1	1584	73.364	73.365
	Cologne spirits. *See* **Ethanol**				
	Columbian spirits. *See* **Methanol**				
	Components, explosive train, n.o.s.	1.4	0383	None	73.105
	Components, explosive train, n.o.s.	1.4	0384	None	73.105
S	**Components, explosive train, n.o.s.**	1.2	0382	None	73.69
S	**Compressed** *or* **liquefied gases** *(flammable, non-toxic),* **n.o.s.**	2.1	1954	73.306	73.302 73.304 73.305
S	**compressed** *or* **liquefied gases,** *(flammable, toxic),* **n.o.s.**	2.1	1953	73.306	73.302 73.304 73.305
	Compressed *or* **liquefied gases,** *(non-flammable, non-toxic),* **n.o.s.**	2.2	1956	73.306 73.307	73.302 73.304 73.305
S	**Compressed** *or* **liquefied gases,** *(non-flammable, toxic),* **n.o.s.**	2.3	1955	None	73.328
S	**Contrivances, water-activated,** *with burster, expelling charge or propelling charge*	1.2	0248	None	73.69
	Contrivances, water-activated, *with burster, expelling charge or propelling charge*	1.3	0249	None	73.69
	Copper acetoarsenite	6.1	1585	73.364	73.367
	Copper arsenite	6.1	1586	73.364	73.365
	Copper based pesticides, *liquid, flammmable, toxic,* **n.o.s.,** *flash point less than 23 °C*	3.2	2776	73.118	73.119
	Copper based pesticides, *liquid, toxic, flammable,* **n.o.s.,** *flash point not less than 23 °C*	6.1	3009	73.345	73.346

(1) Notes	(2) Commodities	(3) Class	(4) Identification Number	(5) Packaging (a) Exemptions	(5) Packaging (b) Specific Requirements
	Copper based pesticides, *liquid, toxic,* **n.o.s.**	6.1	3010	73.345	73.346
	Copper based pesticides, *solid, toxic,* **n.o.s.**	6.1	2775	73.364	73.365
	Copper chlorate	5.1	2721	73.153	73.163
	Copper chloride	8	2802	73.244	73.245b
S	**Copper cyanide**	6.1	1587	73.370	73.370
	Copra	4.2	1363	73.153	73.154
	Cord, detonating, *flexible*	1.4	0289	None	73.104
S	**Cord, detonating,** *flexible*	1.1	0065	None	73.104
S	**Cord, detonating,** *metal clad*	1.1	0290	None	73.104
S	**Cord, detonating,** *metal clad*	1.2	0102	None	73.104
	Cord, detonating, mild effect, *metal clad*	1.4	0104	None	73.104
	Cord, igniter	1.4	0066	None	73.106
	Corrosive liquids, flammable, n.o.s.	8	2920	73.244	73.245
	Corrosive liquids, n.o.s.	8	1760	73.244	73.245 73.245a
	Corrosive liquids, poisonous, n.o.s.	8	2922	73.244	73.245
	Corrosive solids, flammable, n.o.s.	8	2921	73.244	73.245b
	Corrosive solids, n.o.s.	8	1759	73.244	73.245b
	Corrosive solids, poisonous, n.o.s.	8	2923	73.244	73.245b
	Cosmetics, n.o.s. *See* **Perfumery products**				
	Cotton waste, *oily*	4.2	1364	None	73.167
	Cotton, *wet or contaminated*	4.2	1365	73.153	73.154
	Cresols *(o-, m-, p-)*	6.1	2076	73.244	73.245
	Cresylic acid	6.1	2022	73.345	73.346
	Crocidolite. *See* **Asbestos, blue**				
S	**Crotonaldehyde,** *inhibited*	3.2	1143	73.118	73.119
	Crotonic acid	8	2823	73.244	73.245b
	Crotonylene	3.1	1144	73.118	73.119
	Cumene hydroperoxide, *technical pure*	5.2	2116	73.153	73.224
	Cumyl peroxyneodecanoate, *not more than 77% in solution*	5.2	2963	73.153	73.221
	Cumyl Peroxypivalate, *not more than 77% in solution*	5.2	2964	73.153	73.221
	Cupric cyanide. *See* **Copper cyanide**				
	Cupriethylenediamine, *solution*	8	1761	73.244	73.249
	Cut-backs, *asphalt or bitumen*	3.2	1999	73.118	73.119
		3.3	1999	73.118a	None
	Cutters, cable, explosive	1.4	0070	None	73.102
	Cyanide mixtures. *See* **Cyanides,** *(inorganic),* **n.o.s.**				
S	**Cyanides,** *(inorganic),* **n.o.s.**	6.1	1588	73.364	73.370
S	**Cyanides,** *solutions*	6.1	1935	73.345	73.352
S	**Cyanogen**	2.3	1026	None	73.328
S	**Cyanogen bromide**	6.1	1889	None	73.379
S	**Cyanogen chloride,** *inhibited*	2.3	1589	None	73.328
	Cyanuric chloride *(cyanuric trichloride)*	8	2670	73.244	73.245b
S	**Cyclobutane**	2.1	2601	73.306	73.304
	Cyclobutylchloroformate	6.1	2744	73.345	73.346
	1,5,9-Cyclododecatriene	8	2518	73.244	73.245 73.245a
	Cycloheptane	3.2	2241	73.118	73.119
	Cycloheptatriene	3.2	2603	73.118	73.119
	Cycloheptene	3.2	2242	73.118	73.119
	Cyclohexane	3.1	1145	73.118	73.119
	Cyclohexanone	3.3	1915	73.118a	None
	Cyclohexanone peroxide. *See* **1-Hydroxy-1-hydroperoxy dicyclohexyl peroxide** *and mixtures, etc.*				
	Cyclohexene	3.1	2256	73.118	73.119
		3.2	2256	73.118	73.119
	Cyclohexenyl trichlorosilane	8	1762	None	73.280
	Cyclohexyl acetate	3.3	2243	73.118a	None
	Cyclohexylamine	8	2357	73.118	73.119
	Cyclohexyl isocyanate	6.1	2488	73.345	73.346
	Cyclohexyl trichlorosilane	8	1763	None	73.280
	Cyclooctadienes	3.3	2520	73.118a	None
	Cyclooctatetraene	3.2	2358	73.118	73.119
	Cyclopentane	3.1	1146	73.118	73.119
	Cyclopentanol	3.3	2244	73.118a	None
	Cyclopentanone	3.3	2245	73.118a	None
	Cyclopentene	3.1	2246	73.118	73.119
S	**Cyclopropane**	2.1	1027	73.306	73.304
S	**Cyclotetramethylenetetranitramine,** *containing, by weight, at least 15% water or at least 10% phlegmatizer*	1.1	0226	None	73.61
S	**Cyclotrimethylenetrinitramine,** *containing, by weight, at least 15% water or at least 10% phlegmatizer*	1.1	0072	None	73.61
S	**Cyclotrimethylenetrinitramine mixed with cyclotetramethylenetetranitramine,** *containing, by weight, at least 15% water or at least 10% phlegmatizer*	1.1	0391	None	73.61
	p-Cymene	3.3	2046	73.118a	None
	Decaborane	4.1	1868	None	73.236
	Decahydronaphthalene	3.3	1147	73.118a	None
	Decalin. *See* **Decahydronaphthalene**				
	n-Decane	3.3	2247	73.118a	None
	Decanoyl peroxide, *technical pure*	5.2	2120	73.153	73.154
	Deflagrating metal salts of aromatic nitroderivatives, n.o.s.	1.3	0132	None	73.61

(1) Notes	(2) Commodities	(3) Class	(4) Identification Number	(5) Packaging (a) Exemptions	(5) Packaging (b) Specific Requirements
	Detonators for ammunition	1.4	0365	None	73.113
	Detonators for ammunition	1.4	0366	None	73.113
S	**Detonators for ammunition**	1.1	0073	None	73.68
S	**Detonators for ammunition**	1.2	0364	None	73.68
	Detonator assemblies, *non-electric. See* **Blasting cap assemblies,** *non-electric*				
	Detonators, *electric. See* **Blasting caps,** *electric*				
	Detonators,*non-electric. See***Blasting caps,** *non-electric*				
S	**Deuterium**	2.1	1957	73.306	73.302 73.304 73.305
	Diacetone alcohol	3.2	1148	73.118	73.119
		3.3	1148	73.118a	None
	Diacetone alcohol peroxides, *maximum 57% in solution with maximum 9% hydrogen peroxide, minimum 26% diacetone alcohol and minimum 9% water, total active oxygen content maximum 9%*	5.2	2163	73.153	73.221
	Diacetyl Peroxide. *See* **Acetyl Peroxide**				
	Diallylamine	3.2	2359	73.118	73.119
	Diallylether	3.2	2360	73.118	73.119
	Di(n-butyl)amine	8	2248	73.244	73.245
S	**Diazodinitrophenol,** *containing, by weight at least 40% water or mixture of alcohol and water*	1.1	0074	None	73.70
	Dibenzoyl peroxide. *See* **Benzoyl peroxide**				
	Dibenzyldichlorosilane	8	2434	73.244	73.245 73.245a
	Dibenzyl perdicarbonate, *maximum concentration 87% with water*	5.2	2149	73.153	73.154
	Dibenzyl peroxydicarbonate. *See* **dibenzyl perdicarbonate**				
S	**Diborane**	2.1	1911	None	73.302
	Dibromobenzene	3.3	2711	73.118a	None
	1,2-dibromobutan-3-one	6.1	2648	73.345	73.346
	Dibutyl ether	3.3	1149	73.118a	None
	Di-sec-butyl perdicarbonate, *maximum concentration 52% in solution*	5.2	2151	73.153	73.221
	Di-sec-butyl perdicarbonate, *technical pure*	5.2	2150	73.153	73.221
	Di-sec-butyl peroxydicarbonate. *See* **Di-sec-butyl perdicarbonate**				
	Dicetyl perdicarbonate, *technical pure*	5.2	2164	73.153	73.154
	Dicetyl peroxydicarbonate.. *See* **Dicetyl perdicarbonate**				
	Dichloroacetic acid	8	1764	73.244	73.245
	Dichloroacetyl chloride	8	1765	73.244	73.247
	Dichloroaniline	6.1	1590	73.364	73.365
	2,4-Dichlorobenzoyl peroxide, *maximum concentration 75% with water*	5.2	2137	73.153	73.154
	2,4-Dichlorobenzoyl peroxide, *maximum concentration 52% as a paste*	5.2	2138	73.153	73.154
	2,4-Dichlorobenzoyl peroxide, *maximum concentration 52% in solution*	5.2	2139	73.153	73.221
	Dichlorodifluoromethane	2.2	1028	73.306	73.304 73.314 73.315
S	**sym-Dichlorodimethyl ether**	6.1	2249	73.345	73.346
	1,1-Dichloroethane	3.2	2362	73.118	73.119
	Dichloroethylene	3.2	1150	73.118	73.119
	Dichloroethyl ether	6.1	1916	73.345	73.346
	Dichlorodifluoromethane and difluoroethane, *azeotropic mixture with approximately 74% dichlorodifluoromethane*	2.2	2602	73.306 73.307	73.302 73.304 73.305
	Dichloroisocyanuric acid, *dry or* **dichloroisocyanuric acid salts**	5.1	2465	73.153	73.217
	Dichloroisopropyl ether	6.1	2490	73.244	73.254
	Dichloromonofluoromethane	2.2	1029	73.306 73.307	73.302 73.304 73.305
	1,1-Dichloro-1-nitroethane	6.1	2650	73.345	73.346
	1,3-Dichloropropanol-2	6.1	2750	73.345	73.346
	Dichloropentanes	3.3	1152	73.118a	None
S	**Dichlorophenyl isocyanates**	6.1	2250	73.364	73.365
	Dichlorophenyl trichlorosilane	8	1766	None	73.280
	Dichloropropene	3.3	2047	73.118a	None
S	**Dichlorosilane**	2.3	2189	None	73.328
	Dichlorotetrafluoroethane	2.2	1958	73.306 73.307	73.302 73.304 73.305
	Dicumyl peroxide, *technical pure or in a mixture with inert solid, or not more than 50% in solution*	5.2	2121	73.153	73.154 73.224
	Dicyclohexylamine	8	2565	73.244	73.245 73.245a
	Dicyclohexyl perdicarbonate, *maximum concentration 91% with water*	5.2	2153	73.153	73.154
	Dicyclohexyl perdicarbonate, *technical pure*	5.2	2152	73.153	73.154
	Dicyclohexyl peroxydicarbonate. *See* **Dicyclohexyl perdicarbonate**				
	Dicycloheptadiene	3.2	2251	73.118	73.119
	Dicyclopentadiene	3.3	2048	73.118a	None
	Didymium nitrate	5.1	1465	73.153	73.154
	1,2-di(dimethylamino)ethane	3.2	2372	73.118	73.119
	Diethoxymethane	3.1	2373	73.118	73.119
	3,3-Diethoxypropene	3.2	2374	73.118	73.119
S	**Diethylaluminium chloride**	4.2	1101	73.153	73.154
	Diethylamine	3.1	1154	73.118	73.119

(1) Notes	(2) Commodities	(3) Class	(4) Identification Number	(5) Packaging (a) Exemptions	(5) Packaging (b) Specific Requirements
	Diethylaminoethanol	3.3	2686	73.118a	None
	Diethylbenzene	3.3	2049	73.118a	None
	Diethylcarbinol	3.3	2706	73.118a	None
	Diethyl carbonate	3.3	2366	73.118a	None
	Diethyl dichlorosilane	8	1767	None	73.135
S	**Diethyleneglycol dinitrate,** *containing, by weight, at least 25% non-volatile water-insoluble phlegmatizer*	1.1	0075	None	73.61
	Diethylenetriamine	8	2079	73.244	73.245 73.245a
	Diethyl ether	3.1	1155	None	73.119
	Di-(2-ethylhexyl) perdicarbonate, *not more than 77% in solution*	5.2	2123	73.153	73.221
	Di-(2-ethylhexyl) perdicarbonate, *technical pure*	5.2	2122	73.153	73.221
	Di-(2-ethylhexyl) peroxydicarbonate. *See* **Di-(2-ethylhexyl) perdicarbonate**				
	Diethyl ketone	3.2	1156	73.118	73.119
	Diethylmagnesium	4.2	1367	73.118	73.119
	Diethyl perdicarbonate, *maximum concentration 27% in solution*	5.2	2175	73.153	73.221
	Diethyl peroxydicarbonate. *See* **Diethyl perdicarbonate**				
	Diethyl-p-nitrosoaniline	4.2	—	73.153	73.154
	Diethyl sulfide	3.2	2375	73.118	73.119
	Diethylaminopropylamine	8	2684	73.244	73.245
	Diethylthiophosphoryl chloride	8	2751	73.244	73.245
S	**Diethyl sulphate**	6.1	1594	73.345	73.346
	Diethylzinc	4.2	1366	73.118	73.119
S	**1,1-Difluoroethane**	2.1	1030	73.306	73.304 73.314 73.315
S	**1,1-Difluoroethylene**	2.1	1959	73.306	73.302 73.304 73.305
	Difluorophosphoric acid, *anhydrous*	8	1768	None	73.275
	2,2-Dihydroperoxy propane, *maximum concentration 25% with inert organic solid*	5.2	2178	73.153	73.154
	2,3-Dihydropyran	3.2	2376	73.118	73.119
	Diisobutylamine	3.3	2361	73.118a	None
	Diisobutylene, *(isomeric compounds)*	3.2	2050	73.118	73.119
	Diisobutyl ketone	3.3	1157	73.118a	None
	Diisooctyl acid phosphate	8	1902	73.244	73.296
	Diisopropylamine	3.2	1158	73.118	73.119
	Diisopropylbenzene hydroperoxide, *maximum concentration 72% in solution*	5.2	2171	73.153	73.224
	Diisobutyryl peroxide. *See* **Isobutyryl peroxide**				
	Diisopropylethanolamine	8	2825	73.244	73.245
	Diisopropyl ether	3.1	1159	73.118	73.119
	Diisopropyl perdicarbonate, *technical pure*	5.2	2133	Forbidden	Forbidden
	Diisopropyl perdicarbonate, *maximum concentration 52% in solution*	5.2	2134	73.153	73.221
	Diketene, *inhibited*	3.3	2521	73.118a	None
	1,1-Dimethoxyethane	3.2	2377	73.118	73.119
	1,2-Dimethoxyethane	3.2	2252	73.118	73.119
S	**Dimethylamine,** *anhydrous*	2.1	1032	73.306	73.304 73.314 73.315
	Dimethylamine, *solution*	3.2	1160	73.118	73.119
	2-Dimethylaminoacetonitrile	3.3	2378	73.118a	None
	Dimethylaminoethyl methacrylate	6.1	2522	73.345	73.346
	N,N-Dimethylaniline	6.1	2253	73.345	73.346
	2,5-Dimethyl-2,5-bis-(benzoylperoxy) hexane, *maximum concentration 82% with inert solid*	5.2	2173	73.153	73.154
	2,5-Dimethyl-2,5-bis-(benzoylperoxy) hexane, *technical pure*	5.2	2172	73.153	73.154
	Dimethylcarbamoyl chloride	8	2262	73.244	73.245
	Dimethylcyclohexylamine	8	2264	73.244	73.245
	2,5-Dimethyl-2,5-di-(bensoylperoxy) hexane, *not ore than 82% with water*	5.2	2959	73.153	73.221
	2,5-Dimethyl-2,5-bis-(tert-butylperoxy) hexane, *maximum concentration 52% with inert solid*	5.2	2156	73.153	73.154
	2,5-Dimethyl-2,5-bis-(tert-butylperoxy) hexane, *technical pure*	5.2	2155	73.153	73.221
	2,5-Dimethyl-2,5-bis-(tert-butylperoxy) hexyne-3, *maximum concentration 52% with inert solid*	5.2	2159	73.153	73.154
	2,5-Dimethyl-2,5-bis-(tert-butylperoxy) hexyne-3, *technical pure*	5.2	2158	73.153	73.221
	2,5-Dimethyl-2,5-bis-(2-ethylhexanoyl-peroxy) hexane, *technical pure*	5.2	2157	73.153	73.221
	Dimethylbutane	3.1	2457	73.118	73.119
	1,3-Dimethylbutylamine	3.2	2379	73.118	73.119
	Dimethyl carbonate	3.2	1161	73.118	73.119
	Dimethylcyclohexanes	3.2	2263	73.118	73.119
	Dimethyldichlorosilane	3.2	1162	None	73.135
	Dimethyldiethoxysilane	3.2	2380	73.118	73.119
	2,5-dimethyl-2,5-dihydroperoxy hexane, *maximum concentration 82% with water*	5.2	2174	None	73.157
	3,5-dimethyl-3,5-dihydroxydioxolane-1,2. *See* **Acetyl acetone peroxide,** *maximum concentration 40% in solution*				
	Dimethyldioxanes	3.2	2707	73.118	73.119
		3.3	2707	73.118a	None
	Dimethyl disulfide	3.2	2381	73.118	73.119
	Dimethylethanolamine	3.3	2051	73.118a	None
S	**Dimethyl ether**	2.1	1033	73.306	73.304 73.314 73.315
	N,N-Dimethylformamide3.3	2265	73.118a	None	

(1) Notes	(2) Commodities	(3) Class	(4) Identification Number	(5) Packaging (a) Exemptions	(5) Packaging (b) Specific Requirements
	2,5-Dimethylhexane-2,5-dihydroperoxide. *See* **2,5-Dimethyl-2,5-dihydroperoxy hexane**				
	Dimethylhydrazine, *symmetrical*	3.2	2382	73.118	73.119
	Dimethylhydrazine, *unsymmetrical*	3.2	1163	None	73.145
	Dimethylmagnesium	4.2	1368	73.153	73.154
	Dimethyl-p-nitrosoaniline	4.2	1369	73.153	73.154
S	**2,2-Dimethylpropane**	2.1	2044	73.306	73.302 73.304 73.305
	Dimethyl-N-propylamine	3.2	2266	73.118	73.119
S	**Dimethyl sulphate**	6.1	1595	None	73.255
	Dimethyl sulphide	3.1	1164	None	73.119
	Dimethyl thiophosphoryl chloride	8	2267	73.244	73.245 73.245a
	Dimethylzinc	4.2	1370	73.118	73.119
	Dimyristylperoxydicarbonate, *technical pure*	5.2	2595	73.153	73.154
	Di-(n-butyl)amine	8	2248	73.244	73.245 73.245a
	Dinitroanilines	6.1	1596	73.364	73.365
S	**Dinitrobenzenes**	6.1	1597	73.364	73.371
	Dinitrogen tetroxide. *See* **Nitrogen dioxide**				
S	**4,6-Dinitro-o-cresol**	6.1	1598	73.364	73.365
	Dinitrophenates *(alkali metals), dry or containing, by weight, less than 15% water*	1.3	0077	None	73.61
	Dinitrophenolates, *wetted with not less than 15% of water*	4.1	1321	73.153	73.154
S	**Dinitrophenol,** *dry or containing, by weight, less than 15% water*	1.1	0076	None	73.61
	Dinitrophenol, *solution in water or flammable liquid*	6.1	1599	73.345	73.362a
	Dinitrophenol, *wetted with not less than 15% of water*	4.1	1320	73.153	73.154
S	**Dinitroresorcinol,** *dry or containing, by weight, less than 15% water*	1.1	0078	None	73.61
	Dinitroresorcinols, *wetted with not less 15% water, by weight*	4.1	1322	73.153	73.154
	Dinitrosobenzene	1.3	0406	None	73.61
	Dinitrotoluenes, *liquid*	6.1	1600	73.345	73.346
	Dinitrotoluenes, *solid*	6.1	2038	73.364	73.365
	Di-n-propyl perdicarbonate. *See* **Di-n-propyl peroxydicarbonate**				
	Di-n-propyl peroxydicarbonate, *technical pure*	5.2	2176	73.153	73.154
	Dioxane	3.2	1165	73.118	73.119
	Dioxolane	3.2	1166	73.118	73.119
	Dipentene	3.3	2052	73.118a	None
S	**Diphenylaminechloroarsine**	6.1	1698	None	73.328
S	**Diphenylchloroarsine**	6.1	1699	73.364	73.365
	Diphenyl dichlorosilane	8	1769	None	73.280
	Diphenylmethane diisocyanate	9	2489	73.386	None
	Diphenylmethyl bromide	8	1770	73.244	73.245b
S	**Dipicryl sulphide,** *dry or wetted with less than 10% water, by weight*	1.1	0401	None	73.61
	Dipropionyl peroxide. *See* **Propionyl peroxide**				
	Dipropylamine	3.2	2383	73.118	73.119
	Dipropylketone. *See* **Butyrone**				
	Dipropylene triamine	8	2269	73.244	73.245
	Dipropyl ether	3.1	2384	73.118	73.119
	Disinfectants, *corosive, liquid,* **n.o.s.**	8	1903	73.244	73.245
	Disinfectants, (poisonous), n.o.s.	6.1	1601	73.345	73.346
		9	1601	73.386	None
	Distearylperoxydicarbonate, *not more than 85% with stearyl alcohol*	5.2	2592	73.153	73.154
	Disuccinic acid peroxide. *See* **Succinic acid peroxide**				
	Dithiocarbamate pesticides, *liquid, flammable, toxic,* **n.o.s.,** *flash point less than 23°C*	3.2	2772	73.118	73.119
	Dithiocarbamate pesticides, *liquid, toxic, flammable,* **n.o.s.,** *flash point not less than 23°C*	6.1	3005	73.345	73.346
	Dithiocarbamate pesticides, *liquid, toxic* **n.o.s.**	6.1	3006	73.345	73.346
	Dithiocarbamate pesticides, *solid, toxic* **n.o.s.**	6.1	2771	73.364	73.365
	Divinyl ether, *inhibited*	3.1	1167	None	73.119
	Dodecyl trichlorosilane	8	1771	None	73.280
	Dressing, leather. *See* **Flammable liquid preparations, n.o.s.**				
	Driers, *(paint or varnish, liquid)* **n.o.s.**	3.2	1168	73.118	73.128
		3.3	1168	73.118a	None
	Driers, *(paint or varnish, solid),* **n.o.s.**	4.1	1371	73.153	73.154
	Dye intermediates, *(poisonous, liquid or solid),* **n.o.s.**	6.1	1602	73.345	73.346
				73.364	73.365
	Dye intermediates, *(liquid)* **n.o.s.**	8	2801	73.244	73.249a
	Electrolyte, *acid. See* **Battery fluid,** *acid*				
	Electrolyte, *alkaline See* **Battery fluid,** *alkaline corrosive*				
	Enamels. *See* **Paints,** *etc.*				
	Engine starting fluid, *with flammable gas*	2.1	1960	None	73.304
	Epibromohydrin	6.1	2558	73.345	73.346
S	**Epichlorohydrin**	6.1	2023	73.118	73.119
	1,2-Epoxy-3-ethyloxy propane	3.3	2752	73.118a	None
	Eradicators, *paint or grease, liquid. To be classified and labeled accoriding to the principle hazardous constituent*		1850	73.118	73.119
	Essences. *See* **Extracts,** *aromatic, liquid*				
	Etching Acid, *liquid,* **n.o.s.**	8	1790	None	73.299
S	**Ethane,** *compressed*	2.1	1035	73.306	73.304
S	**Ethane,** *liquid*	2.1	1961	73.306	73.302 73.304 73.305
	Ethanol	3.2	1170	73.118	73.125

(1) Notes	(2) Commodities	(3) Class	(4) Identification Number	(5) Packaging (a) Exemptions	(5) Packaging (b) Specific Requirements
	Ethanolamine, *and solutions thereof*	8	2491	73.244	73.245
	Ether. *See* **Diethyl ether**				
	Ethyl acetate	3.2	1173	73.118	73.119
S	**Ethyl acetylene,** *inhibited*	2.1	2452	73.306	73.304
	Ethyl acrylate,*inhibited*	3.2	1917	73.118	73.119
	Ethyl alcohol. *See* **Ethanol**				
	Ethyl aldehyde. *See* **Acetaldehyde**				
	Ethyl aluminium dichloride	4.2	1924	73.118	73.119
S	**Ethyl aluminium sesquichloride**	4.2	1925	73.118	73.119
S	**Ethylamine**	2.1	1036	None	73.148
	Ethylamine solution *with not less than 50% but not more than 70% ethylamine*	3.1	2270	73.118	73.119 73.148
	Ethylamine solution *with not less than 50% but not more than 70% ethylamine*	3.2	2270	73.118	73.119 73.148
		3.3	2270	73.118a	None
	Ethyl amyl ketone	3.3	2271	73.118a	None
	Ethylbenzene	3.2	1175	73.118	73.119
	Ethyl-3,3-bis(tert-butylperoxy) butyrate,*maximum concentration 77% in solution*	5.2	2185	73.153	73.221
	Ethyl-3,3-bis(tert-butylperoxy) butyrate, *technical pure*	5.2	2184	73.153	73.221
	Ethyl-3,3-bis(tert-butylperoxy) butyrate, *with at least 50% inert, inorganic solid*	5.2	2598	73.153	73.154
	Ethyl borate	3.2	1176	73.118	73.119
	Ethyl bromide	6.1	1891	73.386	None
S	**Ethyl bromoacetate**	6.1	1603	73.345	73.346
	2-Ethylbutanol	3.3	2275	73.118a	None
	Ethylbutyl acetate	3.3	1177	73.118a	None
	Ethyl butyl ether	3.2	1179	73.118	73.119
	2-Ethylbutyraldehyde	3.2	1178	73.118	73.119
	Ethyl butyrate	3.3	1180	73.118a	None
S	**Ethyl chloride**	2.1	1037	None	73.123
	Ethyl chloroacetate	6.1	1181	73.345	73.346
	Ethyl chlorocarbonate. *See* **Ethyl chloroformate**				
	Ethyl chloroformate	3.2	1182	None	73.288
	Ethyl-2-chloropropionate	3.3	2935	73.118a	None
	Ethyl chlorothioformate	8	2826	73.244	73.245 73.245a
	Ethyl crotonate	3.2	1862	73.118	73.119
S	**Ethyl dichloroarsine**	6.1	1892	73.345	73.346
	Ethyldichlorosilane	4.3	1183	None	73.135
	Ethylene chlorohydrin. *See* **2-Chloro-ethanol**				
S	**Ethylene,** *compressed*	2.1	1962	73.306	73.304
	Ethylenediamine	8	1604	73.244	73.245
	Ethylene dibromide	6.1	1605	73.345	73.346
	Ethylene dichloride	3.2	1184	73.118	73.119
	Ethylene Glycol diethyl ether	3.3	1153	73.118a	None
	Ethylene Glycol Monoethyl ether	3.3	1171	73.118a	None
	Ethylene Glycol Monoethyl ether acetate	3.3	1172	73.118a	None
	Ethylene glycol monomethyl ether	3.3	1188	73.118a	None
	Ethylene glycol monomethyl ether acetate	3.3	1189	73.118a	None
	Ethylene oxide and propylene oxide mixture, *not more than 30% ethylene oxide*	3.1	2983	73.118	73.119
	Ethyleneimine, *inhibited*	6.1	1185	None	73.139
S	**Ethylene,** *liquid*	2.1	1038	73.306	73.302 73.304 73.305
S	**Ethylene oxide,** *pure or with nitrogen*	2.1	1040	None	73.124
	Ethyl ether. *See* **Diethyl ether**				
	Ethyl fluoride	2.1	2453	73.306	73.302
	Ethyl formate	3.1	1190	73.118	73.119
	Ethyl hexaldehyde	3.3	1191	73.118a	None
	2-Ethylhexylchloroformate	6.1	2748	73.345	73.346
	2-Ethylhexylamine	8	2276	73.244	73.245 73.245a
	Ethylisobutyrate	3.2	2385	73.118	73.119
	Ethyl isocyanate	3.2	2481	73.118	73.119
	Ethyl lactate	3.3	1192	73.118a	None
	Ethyl mercaptan	3.1	2363	None	73.141
	Ethyl methacrylate, *inhibited*	3.2	2277	73.118	73.119
S	**Ethyl methyl ether**	2.1	1039	None	73.119
	Ethyl methyl ketone	3.2	1193	73.118	73.119
	Ethyl methyl ketone peroxide(s), *maximum concentration 60%*	5.2	2127	None	73.119
	Ethyl methyl ketone peroxide, *not more than 50% in solution with more than 9% available oxygen*	5.2	2563	73.153	73.221
	Ethyl methyl ketone peroxide(s), *maximum concentration 50%, containing not more than 9% available oxygen*	5.2	2550	73.153	73.221
	Ethyl nitrite, *solutions*	3.1	1194	None	73.119
	Ethyl orthoformate	3.3	2524	73.118a	None
	Ethylphenyldichlorosilane	8	2435	None	73.280
	1-Ethyl piperidine	3.2	2386	73.118	73.119
	Ethyl proprionate	3.2	1195	73.118	73.119
	Ethyl propyl ether	3.1	2615	73.118	73.119
	Ethyl silicate. *See* **tetraethyl silicate**				
	Ethylsulfuric acid	8	2571	73.244	73.245

(1) Notes	(2) Commodities	(3) Class	(4) Identification Number	(5) Packaging (a) Exemptions	(5) Packaging (b) Specific Requirements
	N-ethyltoluidines	6.1	2754	73.345	73.346
	Ethyltrichlorosilane	3.2	1196	None	73.135
S	**Explosives, blasting, Type A**	1.1	0081	None	73.61
	Explosives, blasting, Type B	1.5	0331	None	73.182(c)
S	**Explosives, blasting, Type B**	1.1	0082	None	73.61
S	**Explosives, blasting, Type C**	1.1	0083	None	73.61
S	**Explosives, blasting, Type D**	1.1	0084	None	73.61
	Explosives, blasting, Type E	1.5	0332	None	73.182(c)
S	**Explosives, blasting, Type E**	1.1	0241	None	73.61
	Extracts, *aromatic, liquid*	3.2	1169	73.118	73.119
		3.3	1169	73.118a	None
	Extracts, *flavouring, liquid*	3.2	1197	73.118	73.119
		3.3	1197	73.118a	None
	Ferric arsenate	6.1	1606	73.364	73.365
	Ferric arsenite	6.1	1607	73.364	73.365
	Ferric chloride, *solution*	8	2582	73.244	73.245
	Ferric chloride, *anhydrous or solution*	8	1773	73.244	73.245b
	Ferric nitrate	5.1	1466	73.153	73.182
	Ferrocerium	4.1	1323	73.153	73.154
	Ferrosilicon, *containing between 30% and 90% silicon*	4.3	1408	73.153	73.154
	Ferrous arsenate	6.1	1608	73.364	73.365
	Ferrous metal borings, shaving, turnings *or* **cuttings** *in a form liable to self heating*	4.2	2793	73.153	73.154
S	**Fertilizer ammoniating solution,** *with free ammonia*	2.2	1043	73.306	73.304 73.314
	Fibres, animal or vegetable, n.o.s., *burnt, wet, or damp*	4.2	1372	None	73.169
	Fibres *or* **Fabrics, animal or vegetable, n.o.s.,** *with animal or vegetable oil*	4.2	1373	None	73.170
	Fillers, *liquid. See* **Paints,** *etc.*				
	Film *from which gelatine has been removed. See* **Celluloid,** *scrap*				
	Film, motion picture, *nitrocellulose base, exposed or unexposed, developed or undeveloped*	4.1	1324	None	73.177
	Film, motion picture, *nitrocellulose base, old film*	4.1	1324	None	73.177
	Fire extinguisher charges, *corrosive liquid*	8	1774	73.261	
	Fire extinguishers, *containing compressed or liquefied gas*	2.2	1044	73.306	73.304
S	**Fireworks, Type A**	1.1	0333	None	73.61
S	**Fireworks, Type B**	1.2	0334	None	73.61
	Fireworks, Type C	1.3	0335	None	73.91
	Fireworks, Type D	1.4	0336	None	73.108
	Fireworks, Type D	1.4	0337	None	73.108
	Fish meal *or* **fish scrap,** *unstabilized*	4.2	1374	None	73.171
	Fish meal *or* **fish scrap,** *stabilized*	9	2216	73.386	None
	Flammable liquid preparation, n.o.s.	3.2	1142	73.118	73.119
		3.3	1142	73.118a	None
	Flammable liquids, *(non-toxic),* **n.o.s**	3.1	1993	73.118	73.119
		3.2	1993	73.118	73.119
		3.3	1993	73.118a	None
	Flammable liquid, corrosive, n.o.s.	3.1	2924	None	73.119
		3.2	2924	None	73.119
	Flammable liquids, *(toxic),* **n.o.s.**	3.1	1992	73.118	73.119
		3.2	1992	73.118	73.119
		3.3	1992	73.118a	None
	Flammable solids, n.o.s.	4.1	1325	73.153	73.154
	Flammable solids, corrosive, n.o.s.	4.1	2925	73.153	73.154
	Flammable solids, poisonous, n.o.s.	4.1	2926	73.153	73.154
S	**Flares, aerial**	1.1	0420	None	73.54
S	**Flares, aerial**	1.2	0421	None	73.54
	Flares, aerial	1.4	0403	None	73.108
	Flares, aerial	1.4	0404	None	73.108
	Flares, aerial	1.3	0093	None	73.91
S	**Flares, surface**	1.1	0418	None	73.54
S	**Flares, surface**	1.2	0419	None	73.54
	Flares, surface *(other than water-activated flares)*	1.3	0092	None	73.91
	Fluoboric acid	8	1775	73.244	73.283
	Fluoric acid. *See* **hydrofluoric acid,** *solution*				
S	**Fluorine**	2.3	1045	None	73.302
	Fluoroacetic acid	6.1	2642	73.364	73.365
	Fluorobenzene	3.2	2387	73.118	73.119
	Fluorophosphoric acid, *anhydrous*	8	1776	None	73.275
	Fluorosulphonic acid	8	1777	None	73.274
	Fluorotoluenes	3.2	2388	73.118	73.119
		3.3	2388	73.118a	None
	Fluosilicic acid	8	1778	None	73.265
	Formaldehyde, *in solutions*	3.3	1198	73.118a	None
	Formaldehyde, *solutions flashpoint above 61 degrees C*	9	2209	73.118a	None
	Formalin. *See* **Formaldehyde**				
	Formic acid	8	1779	73.244	73.289
S	**Fracturing devices,** *explosive, for oil wells*	1.1	0099	None	73.61
	Fuel, aviation, *turbine engine*	3.2	1863	73.118	73.119
	Fuel oil. *See* **Gas oil**				
	Fumaryl chloride	8	1780	73.244	73.245
	Furan	3.1	2389	73.118	73.119
	Furfural	3.3	1199	73.118a	None

(1) Notes	(2) Commodities	(3) Class	(4) Identification Number	(5) Packaging (a) Exemptions	(5) Packaging (b) Specific Requirements
	Furfurylamine	3.3	2526	73.118a	None
	Fusees, *(railway or highway)*	4.1	1325	None	73.154a
	Fuse, igniter, *tubular, metal clad*	1.4	0103	None	73.106
	Fuse, instantaneous, non-detonating	1.3	0101	None	73.91
	Fusel oil	3.2	1201	73.118a	None
	Fuse, safety	1.4	0105	None	73.106
	Fuzes, detonating	1.4	0367	None	73.104
	Fuzes, detonating	1.4	0257	None	73.104
S	**Fuzes, detonating**	1.1	0106	None	73.69
S	**Fuzes, detonating**	1.2	0107	None	73.69
S	**Fuzes, detonating,** *with protective features*	1.1	0408	None	73.69
S	**Fuzes, detonating,** *with protective features*	1.2	0409	None	73.69
	Fuzes, detonating, *with protective features*	1.4	0410	None	73.104
	Fuzes, igniting	1.4	0368	None	73.104
	Fuzes, igniting	1.3	0316	None	73.91
	Fuzes, igniting	1.4	0317	None	73.104
	Gallium	8	2803	73.244	73.245a
	Gas cartridges	2.1	2037	73.306	73.302 73.304 73.305
	Gas drips, *hydrocarbon*	3.2	1864	73.118	73.119
	Gas identification set	2.3	9035	None	73.331
	Gas identification set	6.1	9035	None	73.331
	Gas oil	3.3	1202	73.118a	None
	Gasoline	3.1	1203	73.118	73.119
S	**Germane**	2.3	2192	None	73.328
	Glyceryl trinitrate, *solution up to 1% in alcohol*	3.2	1204	None	73.133
	Glycidaldehyde	3.3	2622	73.118a	None
S	**Grenades,** *hand or rifle, with bursting charge*	1.1	0284	None	73.54
S	**Grenades,** *hand or rifle, with bursting charge*	1.2	0285	None	73.54
S	**Grenades,** *hand or rifle, with bursting charge*	1.1	0292	None	73.54
S	**Grenades,** *hand or rifle, with bursting charge*	1.2	0293	None	73.54
	Grenades, practice, *hand or rifle*	1.4	0110	None	73.107
S	**Grenades, practice,** *hand or rifle*	1.2	0372	None	73.54
	Grenades, practice, *hand or rifle*	1.3	0318	None	73.91
	Guanidine nitrate	5.1	1467	73.153	73.182
S	**Guanyl nitrosamino guanylidene hydrazine** *containing, by weight, at least 30% water*	1.1	0113	None	73.72
S	**Guanyl nitrosamino guanyl tetrazene,** *containing, by weight, at least 30% water or mixture of alcohol and water*	1.1	0114	None	73.78
	Gutta percha, *solution*	3.3	1205	73.118a	None
	Hafnium *metal* **powder, dry**	4.2	2545	None	73.214
	Hafnium *metal* **powder, wetted,** *with not less than 25% water (a visible excess of water must be present)*	4.1	1326	None	72.214
S	**Halogenated irritating liquids, n.o.s.**	6.1	1610	73.345	73.346
	Helium, *compressed*	2.2	1046	73.306	73.302
	Helium, *liquid*	2.2	1963	73.306 73.307	73.302 73.304 73.305 73.314
	Heptane	3.2	1206	73.118	73.119
	n-Heptene	3.2	2278	73.118	73.119
	Hexachlorocyclopentadiene	6.1	2646	73.345	73.346
	Hexadecyl trichlorosilane	8	1781	None	73.280
	Hexadiene	3.1	2458	None	73.119
S	**Hexaethyl tetraphosphate**	6.1	1611	None 73.364	73.358 73.377
S	**Hexaethyl tetraphosphate** *and compressed gas mixture*	2.3	1612	None	73.334
	Hexaethyl tetraphosphate mixture, *liquid*	6.1	3018	None	73.359
	Hexaethyl tetraphosphate mixture, *dry*	6.1	2783	73.377	73.377
S	**Hexafluoroacetone**	2.3	2420	None	73.328
	Hexafluoroacetone hydrate	6.1	2552	73.345	73.346
	Hexafluoroethane	2.2	2193	73.306	73.304
	Hexafluorophosphoric acid	8	1782	None	73.275
	Hexafluoropropylene	2.2	1858	73.306	73.304 73.314 73.315
	Hexaldehyde	3.3	1207	73.118a	None
	Hexamethylenediamine, *solid*	8	2280	73.244	73.245b
	Hexamethylenediamine, *solution*	8	1783	73.244	73.292
	Hexamethylenediisocyanate	6.1	2281	73.345	73.346
	Hexamethyleneimine	3.2	2493	73.345	73.346
	3,3,6,6,9,9-Hexamethyl-1,2,4,5-tetraoxocyclononane, *not more than 52% with inert solid*	5.2	2166	73.153	73.154
	3,3,6,6,9,9-Hexamethyl-1,2,4,5-tetraoxocyclononane, *not more than 52% in solution*	5.2	2167	73.153	73.221
	3,3,6,6,9,9-Hexamethyl-1,2,4,5-tetraoxocyclononane, *technically pure*	5.2	2165	73.153	73.154
	Hexamine	4.1	1328	73.153	73.154
	Hexane	3.1	1208	73.118	73.119
S	**Hexanitrodiphenylamine**	1.1	0079	None	73.61
S	**Hexanitrostilbene**	1.1	0392	None	73.61
	Hexanols	3.3	2282	73.118a	None
S	**Hexatonal,** *cast*	1.1	0393	None	73.61
	1-Hexene	3.1	2370	73.118	73.119

(1) Notes	(2) Commodities	(3) Class	(4) Identification Number	(5) Packaging (a) Exemptions	(5) Packaging (b) Specific Requirements
S	**Hexolite,** *dry or containing, by weight, less than 15% water*	1.1	0118	None	73.61
	Hexyl trichlorosilane	8	1784	None	73.280
	Hydrazine, *anhydrous and solutions containing less than 36% water, by weight*	3.3	2029	None	73.276
	Hydrazine, *solutions containing 36% or more water, by weight*	8	2030	None	73.276
	Hydrides, *(metal),* **n.o.s.**	4.3	1409	73.153	73.154
	Hydriodic acid	8	1787	73.244	73.245
	Hydrobromic acid	8	1788	None	73.262
S	**Hydrocarbon gases** *(and mixtures of such gases, compressed),* **n.o.s**	2.1	1964	73.306	73.302
S	**Hydrocarbon gases** *(and mixtures of such gases, liquefied),* **n.o.s**	2.1	1965	73.306	73.304 73.314
	Hydrochloric acid	8	1789	73.244	73.263
	Hydrochloric acid, *solutions*	8	1789	73.244	73.263
	Hydrocyanic acid, *anhydrous. See* **Hydrogen cyanide**				
S	**Hydrocyanic acid,** *aqueous solution of not more than 20% of hydrogen cyanide*	6.1	1613	None	73.332 73.351
	Hydrofluoric acid, *solution*	8	1790	73.244	73.264
S	**Hydrofluoric and sulphuric acid mixtures**	8	1786	None	73.290
	Hydrofluosilicic acid. *See* **Fluosilicic acid**				
S	**Hydrogen and methane,** *mixtures*	2.1	2034	73.306	73.302 73.304 73.305
S	**Hydrogen bromide,** *anhydrous*	2.4	1048	73.306	73.304
S	**Hydrogen chloride,** *anhydrous*	2.4	1050	73.306	73.304
S	**Hydrogen chloride,** *refrigerated liquid*	2.4	2186	73.306	73.304 73.314
S	**Hydrogen,** *compressed*	2.1	1049	73.306	73.302 73.314
S	**Hydrogen cyanide,** *anhydrous, stabilized*	6.1	1051	None	73.332
S	**Hydrogen cyanide,** *anhydrous, stabilized, absorbed in a porous inert materia*	6.1	1614	73.345	73.346
S	**Hydrogen fluoride,** *anhydrous*	2.4	1052	None	73.264
S	**Hydrogen iodide,** *anhydrous*	2.4	2197	None	73.328
	Hydrogen iodide, *solution. See* **Hydriodic acid**				
S	**Hydrogen,** *liquid*	2.1	1966	None	73.316
	Hydrogen peroxide, *aqueous solution, with not less than 8% but less than 20% hydrogen peroxide (stabilized as necessary)*	5.1	2984	73.244	73.266
	Hydrogen peroxide, *aqueous solutions with not less than 20% but not more than 60% hydrogen peroxide (stabilized as necessary)*	5.1	2014	73.244	73.266
	Hydrogen peroxide, *stabilized or* **hydrogen peroxide,** *aqueous solutions, stabilized with more than 60% hydrogen peroxide*	5.1	2015	None	73.266
S	**Hydrogen selenide**	2.3	2202	None	73.328
S	**Hydrogen sulphide**	2.1	1053	None	73.304 73.314
	Hydrosilicofluoric acid. *See* **Fluosilicic acid**				
	Hydroxylamine sulphate	8	2865	73.244	73.245b
	1-Hydroxy-1-hydroperoxy dicyclohexyl peroxide, *not more than 72% as a paste with not more than 9% available oxygen*	5.2	2896	73.153	73.157 73.158
	1-Hydroxy-1-hydroperoxy dicyclohexyl peroxide, *and mixtures with bis-(1-hydroxy cyclohexyl) peroxide, in a concentration of more than 90% with less than 10% water*	5.2	2117	73.153	73.154
	1-Hydroxy-1-hydroperoxy dicyclohexyl peroxide, *and mixtures with bis-(1-hydroxy cyclohexyl) peroxide, in a concentration of 90% or less with at least 10% water*	5.2	2119	73.157	73.158
	1-Hydroxy-1-hydroperoxy dicyclohexyl peroxide, *and mixtures with bis-(1-hydroxy cyclohexyl) peroxide, maximum concentration 72% as a paste or in solution*	5.2	2118	73.157	73.158
	Hypochlorite, *solutions*	8	1791	73.244	73.277
	Igniters	1.4	0325	None	73.106
S	**Igniters**	1.1	0121	None	73.69
S	**Igniters**	1.2	0314	None	73.69
	Igniters	1.3	0315	None	73.91
	Igniter for aircraft thrust device, *for assisted take-off*	4.1	2792	None	73.238
	Ink, printers	3.2	1210	73.118	73.144
		3.3	1210	73.118a	None
	Insecticide gases, *(non-toxic),* **n.o.s.**	2.2	1968	73.306	73.304
S	**Insecticide gases,** *(toxic),* **n.o.s.**	2.3	1967	None	73.329 73.334
	Iodine monochloride	8	1792	None	73.293
	Iodine pentafluoride	5.1	2495	None	73.246
	2-Iodobutane	3.2	2390	73.118	73.119
	Iodomethylpropanes	3.2	2391	73.118	73.119
	Iodopropanes	3.2	2392	73.118	73.119
		3.3	2392	73.118a	None
	3,3-Iminodipropylamine. *See* **Dipropylene triamine**				
	Iron carbonyl	6.1	1994	73.118	73.119
	Iron chloride. *See* **Ferric chloride**				
	Iron oxide, *spent*	4.2	1376	None	73.174
	Iron pentacarbonyl. *See* **Iron carbonyl**				
	Iron sesquichloride. *See* **Ferric chloride**				
	Iron sponge, *spent. See* **iron oxide,** *spent*				
S	**Isobutane** *or* **isobutane mixtures**	2.1	1969	73.306	73.304 73.314 73.315
	Isobutanol	3.3	1212	73.118a	None
	Isobutyl acetate	3.2	1213	73.118	73.119

(1) Notes	(2) Commodities	(3) Class	(4) Identification Number	(5) Packaging (a) Exemptions	(5) Packaging (b) Specific Requirements
	Isobutyl acrylate, *inhibited*	3.3	2527	73.118a	None
	Isobutyl alcohol. *See* **isobutanol**				
	Isobutyl aldehyde. *See* **isobutyraldehyde**				
	Isobutylamine	3.2	1214	73.118	73.119
S	**Isobutylene**	2.1	1055	73.306	73.304 73.314 73.315
	Isobutyl formate	3.2	2393	73.118	73.119
	Isobutylisobutyrate	3.3	2528	73.118a	None
	Isobutyl isocyanate	3.2	2486	73.118	73.119
	Isobutyl methacrylate, *inhibited*	3.3	2283	73.118a	None
	isobutyl methyl ketone peroxide, *maximum concentration 62% in solution*	5.2	2126	73.153	73.221
	Isobutyl propionate	3.2	2394	73.118	73.119
	Isobutyraldehyde	3.1	2045	73.118	73.119
	Isobutyric acid	9	2529	73.386	None
	Isobutyric anhydride	3.3	2530	73.118a	None
	Isobutyronitrile	3.2	2284	73.118	73.119
	Isobutyryl chloride	3.2	2395	73.118	73.119
	Isobutyryl peroxide, *maximum concentration 52% in solution*	5.2	2182	73.153	73.221
	Isocyanates *(and solutions),* **n.o.s.**	3.1	2478	73.118	73.119
		3.2	2478	73.118	73.119
	Isocyanates *(with a boiling point below 300 degrees C and a flashpoint of 23 degrees C or above, and their solutions)* **n.o.s.**	6.1	2206	73.345	73.346
	Isododecane	3.3	2286	73.118a	None
	Isoheptene	3.1	2287	73.118	73.119
	Isohexene	3.1	2288	73.118	73.119
	Isononanoyl peroxide, *technical pure or in solution*	5.2	2128	73.153	73.221
	Isocyanatobenzotrifluorides	6.1	2285	73.345	73.346
	Isooctene	3.2	1216	73.118	73.119
	Isopentane	3.1	1265	73.118	73.119
	Isopentenes	3.1	2371	73.118	73.119
	Isophoronediamine	8	2289	73.244	73.245 73.245a
	Isophorone diisocyanate	6.1	2290	73.345	73.346
	Isoprene, *inhibited*	3.1	1218	73.118	73.119
	Isopropanol	3.2	1219	73.118	73.125
	Isopropenyl acetate	3.2	2403	73.118	73.119
	Isopropenylbenzene	3.3	2303	73.118a	None
	Isopropyl acetate	3.2	1220	73.118	73.119
	Isopropyl acid phosphate	8	1793	73.244	73.245b
	Isopropyl alcohol. *See* **Isopropanol**				
	Isopropylamine	3.1	1221	None	73.119
	Isopropylbenzene	3.3	1918	73.118a	None
	Isopropyl butyrate	3.3	2405	73.118a	None
	Isopropyl chloroacetate	3.3	2947	73.118a	None
	Isopropyl chloroformate	3.2	2407	73.118	73.119
	Isopropyl-2-chloropropionate	3.3	2934	73.118a	None
	Isopropylcumyl hydroperoxide. *See* **Diisopropylbenzene hydroperoxide**				
	Isopropyl isobutyrate	3.2	2406	73.118	73.119
	Isopropyl isocyanate	3.2	2483	73.118	73.119
	Isopropyl nitrate	3.2	1222	73.118	73.119
	Isopropyl peroxydicarbonate. *See* **Diisopropyl perdicarbonate**				
	Isopropyl propionate	3.2	2409	73.118	73.119
	Isosorbide dinitrate, *mixture with not less than 60% lactose, mannose, starch, or calcum hydrogen phosphate*	4.1	2907	73.153	73.154
S	**Jet perforating guns, charged,** *oil well, without detonator*	1.1	0124	None	73.61
	Kerosene	3.3	1223	73.118a	None
	ketones, *(liquid, non-toxic),* **n.o.s.**	3.1	1224	73.118	73.119
		3.2	1224	73.118	73.119
		3.3	1224	73.118a	None
	Krypton, *compressed*	2.2	1056	73.306 73.307	73.302 73.304 73.305
	Krypton, *liquid*	2.2	1970	73.306 73.307	73.302 73.304 73.305
	Lacquer base *or* **Lacquer chips,** *dry*	4.1	2557	73.153	73.175
	Lacquer base. *See* **Paints, etc.**				
	Lacquer chips. *See* **Nitrocellulose,** *wetted with, by weight, more than 40% flammable liquids*				
	Lacquers. *See* **Paints, etc.**				
	Lauroyl peroxide, *technical pure*	5.2	2124	73.153	73.158
	Lead arsenates	6.1	1617	73.364	73.367
	Lead arsenites	6.1	1618	73.364	73.365
S	**Lead azide,** *containing, by weight, at least 20% water or mixture of alcohol and water*	1.1	0129	None	73 73
S	**Lead cyanide**	6.1	1620	73.370	73.370
	Lead dioxide	5.1	1872	73.153	73.154
	Lead dross. *See* **Lead sulphate,** *containing more than 3% free acid*				
	Lead nitrate	5.1	1469	73.153	73.182
	Lead perchlorate	5.1	1470	73 153	73 154
	Lead peroxide. *See* **Lead dioxide**				

(1) Notes	(2) Commodities	(3) Class	(4) Identification Number	(5) Packaging (a) Exemptions	(5) Packaging (b) Specific Requirements
	Lead phosphite dibasic	4.1	2989	73.153	73.154
S	**Lead styphnate,** *containing, by weight, at least 20% water or mixture of alcohol and water*	1.1	0130	None	73.74
	Lead sulphate, *containing more than 3% free acid*	8	1794	73.244	73.245b
	Life-rafts, inflatable	9	2990	73.12	73.12
	Lighter fuels, cigar and cigarette	3.2	1226	73.118	73.119
	Lighter *for* **cigars and cigarettes,** *etc. containing flammable gas*	2.1	1057	73.306	73.306
	Lighters *for* **cigars and cigarettes,** *etc. containing fuel*	3.2	1226	73.118	73.119
	Lighters, fuse	1.4	0131	None	73.106
S	**Liquefied petroleum gases**	2.1	1075	73.306	73.304 73.314 73.315
	Liquefied non-flammable gases charged with nitrogen, carbon dioxide *or* **air**	2.2	1058	73.306	73.304
	Lithium alkyls	4.2	2445	73.118	73.119
	Lithium aluminium hydride	4.3	1410	None	73.206
	Lithium aluminium hydride, ethereal	4.3	1411	None	73.137
	Lithium amide	4.3	1412	73.153	73.168
	Lithium borohydride	4.3	1413	None	73.206
	Lithium ferrosilicon	4.3	2830	None	73.206
	Lithium hydride	4.3	1414	None	73.206
	Lithium hydride, *fused solid*	4.3	2805	None	73.206
	Lithium hydroxide monohydrate	8	2680	73.244	73.245b
	Lithium hydroxide, *solution*	8	2679	73.244	73.249
	Lithium hypochlorite, *dry, or mixtures*	5.1	1471	73.153	73.217
	Lithium, *(metal)*	4.3	1415	None	73.206
	Lithium nitrate	5.1	2722	73.153	73.182
	Lithium nitride	4.3	2806	None	73.206
	Lithium peroxide	5.1	1472	73.153	73.154
	Lithium silicon	4.3	1417	None	73.206
	London purple	6.1	1621	73.364	73.365
	Lye, *See* **Sodium hydroxide**				
	Magnesium aluminum phosphide	4.3	1419	None	73.206
	Magnesium arsenate	6.1	1622	73.364	73.367
	Magnesium bromate	5.1	1473	73.153	73.154
	Magnesium chlorate	5.1	2723	73.153	73.163
	Magnesium diamide	4.2	2004	73.153	73.154
	Magnesium diphenyl	4.2	2005	73.153	73.154
	Magnesium granules, *coated, particle size not less than 149 microns*	4.3	2950	73.153	73.178
	Magnesium hydride	4.3	2010	73.153	73.154
	Magnesium nitrate	5.1	1474	73.153	73.182
	Magnesium perchlorate	5.1	1475	73.153	73.154
	Magnesium peroxide	5.1	1476	73.153	73.154
	Magnesium phosphide	4.3	2011	73.153	73.154
	Magnesium, powder *or* **Magnesium alloys,** *powder*	4.3	1418	73.153	73.220
	Magnesium *or* **Magnesium alloys** *with more than 50% magnesium in pellets, turnings or ribbons*	4.1	1869	73.153	73.220
	Magnesium silicide	4.3	2624	73.153	73.154
	Maleic anhydride	8	2215	73.244	73.245b
	Malononitrile	6.1	2647	73.364	73.365
	Maneb, or maneb preparation*(s) containing 60% or more maneb*	4.2	2210	73.153	73.154
	Manganese ethylene-bis-dithiocarbamate. *See* **Maneb**				
	Manganese nitrate	5.1	2724	73.153	73.182
	Manganese resinate	4.1	1330	73.153	73.154
S	**Mannitol hexanitrate,** *containing, by weight, at least 40% water or mixture of alcohol and water*	1.1	0133	None	73.75
	Matches, *fusee*	4.1	2254	73.153	73.154
	Matches, *safety*	4.1	1944	73.176	73.176
	Matches, *strike anywhere*	4.1	1331	None	73.176a
	Matches, *wax vesta*	4.1	1945	73.153	73.154
	MEKP. *See* **Ethyl methyl ketone peroxide**	8	1760	None	73.298
	Memtetrahydro phthalic anhydride p-Menthane hydroperoxide, *or* **p-menthyl hydroperoxide,** *technical pure*	5.2	2125	73.153	73.224
	Mercaptans and mercaptan mixtures, *(liquid),* **n.o.s.**	3.1	1228	73.118	73.141
	Mercuric acetate. *See* **Mercury acetate**				
	Mercuric arsenate	6.1	1623	73.364	73.365
	Mercuric bromide. *See* **Mercury bromides**				
S	**Mercuric chloride**	6.1	1624	73.364	73.372
	Mercuric cyanide. *See* **Mercury cyanide**				
	Mercuric nitrate	6.1	1625	73.153	73.182
	Mercuric oxycyanide. *See* **Mercury oxycyanide**				
S	**Mercuric potassium cyanide**	6.1	1626	73.364	73.365 73.370
	Mercuric sulphate	6.1	1645	73.364	73.365
	Mercurol. *See* **Mercury nucleate**				
	Mercurous acetate. *See* **Mercury acetate**				
	Mercurous bromide. *See* **Mercury bromides**				
	Mercurous nitrate	5.1	1627	73.364	73.365
	Mercurous sulphate	6.1	1628	73.364	73.365
	Mercury acetate	6.1	1629	73.364	73.365
	Mercury ammonium chloride	6.1	1630	73.364	73.365
	Mercury based pesticides, *liquid, flammable, toxic,* **n.o.s.,** *flash point less than 23°C*	3.2	2778	73.118	73.119
	Mercury based pesticides, *liquid, toxic, flammable,* **n.o.s.,** *flash point not less than 23°C*	6.1	3011	73.345	73.346

(1) Notes	(2) Commodities	(3) Class	(4) Identification Number	(5) Packaging (a) Exemptions	(5) Packaging (b) Specific Requirements
	Mercury based pesticides, *liquid, toxic,* **n.o.s.**	6.1	3012	73.345	73.346
	Mercury based pesticides, *solid, toxic,* **n.o.s.**	6.1	2777	73.364	73.365
	Mercury benzoate	6.1	1631	73.364	73.365
	Mercury bisulphate	6.1	1633	73.364	73.365
	Mercury bromides	6.1	1634	73.364	73.365
	Mercury compounds, *liquid,* **n.o.s.**	6.1	2024	73.345	73.346
	Mercury compounds, *solid,* **n.o.s.**	6.1	2025	73.364	73.365
S	**Mercury cyanide**	6.1	1636	73.370	73.370
S	**Mercury fulminate,** *containing, by weight, at least 20% water or mixture of alcohol and water*	1.1	0135	None	73.71
	Mercury gluconate	6.1	1637	73.364	73.365
	Mercury iodide	6.1	1638	73.364	73.365
	Mercury nucleate	6.1	1639	73.364	73.365
	Mercury oleate	6.1	1640	73.364	73.365
	Mercury oxide	6.1	1641	73.364	73.365
	Mercury oxycyanide	6.1	1642	73.364	73.365
	Mercury potassium iodide	6.1	1643	73.364	73.365
	Mercury salicylate	6.1	1644	73.364	73.365
	Mercury thiocyanate	6.1	1646	73.364	73.365
	Mesityl oxide	3.3	1229	73.118a	None
	Metal alkyls, n.o.s.	4.2	2003	73.118	73.119
	Metaldehyde	4.1	1332	73.153	73.154
	Metacrylaldehyde	3.2	2396	73.118	73.119
	Methacrylic acid, *inhibited*	8	2531	73.244	73.245 73.245a
	Methallyl alcohol	3.3	2614	73.118a	None
S	**Methane** *or* **natural gases** *with a high methane content, compressed*	2.1	1971	73.306	73.302
S	**Methane** *or* **natural gases** *with a high methane content, refrigerated liquid*	2.1	1972	73.306	73.302 73.304 73.305
	Methanol	3.2	1230	73.118	73.119
	Methoxymethyl isocyanate	3.2	2605	73.118	73.119
	4-Methoxy-4-methylpentan-2-one	3.3	2293	73.118a	None
	Methyl acetate	3.2	1231	73.118	73.119
	Methyl acetone	3.2	1232	73.118	73.119
S	**Methyl acetylene-propadiene mixtures,** *stabilized*	2.1	1060	73.306	73.304 73.314 73.315
	beta-Methyl acrolein. *See* **Crotonaldehyde,** *inhibited*				
	Methyl acrylate, *inhibited*	3.2	1919	73.118	73.119
	Methylal	3.1	1234	None	73.119
	Methyl alcohol. *See* **Methanol**				
	Methyl allyl chloride	3.1	2554	73.118	73.119
	Methyl aluminium sesquibromide	4.2	1926	73.118	73.119
	Methyl aluminium sesquichloride	4.2	1927	73.118	73.119
S	**Methylamine,** *anhydrous*	2.1	1061	73.306	73.304 73.314 73.315
	Methylamine, *aqueous solution*	3.1	1235	73.118	73.119
	Methylamyl acetate	3.3	1233	73.118a	None
	Methyl amyl ketone. *See* **Amyl methyl ketone**				
S	**Methyl bromide**	2.3	1062	None	73.353
	Methyl bromide and chloropicrin, *mixtures. See* **Chloropicrin and methyl bromide,** *mixtures*				
	Methyl bromide and ethylene dibromide, *liquid mixtures*	6.1	1647	None	73.353
	2-Methyl-1,3-butadiene. *See* **Isoprene**				
	3-Methyl butan-2-one	3.2	2397	73.118	73.119
	2-Methyl-1-butene	3.1	2459	73.118	73.119
	3-Methyl-1-butene	3.1	2561	None	73.119
	N-methylbutylamine	3.2	2945	73.118	73.119
	Methyl-2-chloropropionate	3.3	2933	73.118a	None
	2-Methyl-2-butene	3.1	2460	None	73.119
	Methyl-tert-butyl ether	3.2	2398	73.118	73.119
	Methyl butyrate	3.2	1237	73.118	73.119
S	**Methyl chloride**	2.1	1063	73.306	73.304 73.314 73.315
	Methyl chloride and chloropicrin, *mixtures. See* **Chloropicrin and methyl chloride,** *mixtures*				
S	**Methyl chloride and methylene chloride,** *mixtures*	2.1	1912	73.306	73.304 73.314
	Methyl chloroacetate	6.1	2295	73.345	73.346
	Methyl chlorocarbonate. *See* **Methyl chloroformate**				
	Methyl chloroformate	3.2	1238	None	73.288
	Methylchloromethyl ether	3.1	1239	None	73.143
	Methyl chlorosilane	4.3	2534	73.118	73.119
S	**Methyl cyanide**	3.2	1648	73.118	73.119
	Methyl cyclohexane	3.2	2296	73.118	73.119
	Methyl cyclohexanol	3.3	2617	73.118a	None
	Methyl cyclohexanone	3.3	2297	73.118a	None
	Methyl cyclopentane	3.2	2298	73.118	73.119
	Methyldichlorosilane	3.2	1242	None	73.136
	Methylene bis (phenylene isocyanate). *See* **Diphenylmethane diisocyanate**				
	Methyl ethyl ether. *See* **Ethyl methyl ether**				

(1) Notes	(2) Commodities	(3) Class	(4) Identification Number	(5) Packaging (a) Exemptions	(5) Packaging (b) Specific Requirements
	Methyl ethyl ketone peroxide*(s). See* **Ethyl methyl ketone peroxide**				
	Methyl ethyl ketone. *See* **Ethyl methyl ketone**				
S	**Methyl Fluoride**	2.1	2454	73.306	73.304
	Methyl formate	3.1	1243	73.118	73.119
	2-Methylfuran	3.1	2301	73.118	73.119
	5-Methylhexan-2-one	3.3	2302	73.118a	None
	Methylhydrazine	3.2	1244	None	73.145
	Methyl iodide	6.1	2644	73.345	73.346
	Methyl isobutyl carbinol	3.3	2053	73.118a	None
	Methyl isobutyl ketone	3.2	1245	73.118	73.119
	Methyl isobutyl ketone peroxide. *See* **Isobutyl methyl ketone peroxide**				
	Methyl isocyanate *(and solutions)*	3.2	2480	73.118	73.119
	Methyl isopropenyl ketone, *inhibited*	3.2	1246	73.118	73.119
	Methyl isothiocyanate	3.2	2477	73.118	73.119
	Methylisovalerate	3.2	2400	73.118	73.119
	Methyl magnesium bromide, *in ethyl ether*	4.2	1928	None	73.149
S	**Methylmercaptan**	2.1	1064	73.306	73.304 73.314 73.315
	Methyl methacrylate, *monomer, inhibited*	3.2	1247	73.118	73.119
	Methylmorpholine	3.3	2535	73.118a	None
S	**Methyl nitrite**	2.1	2455	73.306	73.304
	Methyl orthosilicate	3.2	2606	73.118	73.119
	Methyl parathion, *liquid, or mixtures, liquid*	6.1	3018	None	73.358 73.359
	Methyl parathion, *mixture, dry*	6.1	2783	73.377	73.377
	Methylpentadiene	3.1	2461	73.118	73.119
	2-Methylpentan-2-ol	3.3	2560	73.118a	None
	Methylphenyldichlorosilane	3.3	2437	73.118a	None
	1-Methylpiperidine	3.2	2399	73.118	73.119
	Methyl propionate	3.2	1248	73.118	73.119
	Methyl propyl ether	3.1	2612	73.118	73.119
	Methyl propyl ketone	3.2	1249	73.118	73.119
	Methyl sulphide. *See* **Dimethyl sulfide**				
	Methyltetrahydrofuran	3.2	2536	73.118	73.119
	Methyltrichlorosilane	3.2	1250	None	73.135
	alpha-Methyl valeraldehyde	3.3	2367	73.118a	None
	Methyl vinyl ketone	3.2	1251	73.147	73.147
S	**Mines,** *with bursting charge*	1.1	0137	None	73.54
S	**Mines,** *with bursting charge*	1.2	0138	None	73.54
S	**Mines,** *with bursting charge*	1.1	0136	None	73.54
S	**Mines,** *with bursting charge*	1.2	0294	None	73.54
	Mixed acid. *See* **Acid mixtures,** *nitrating acid*				
	Mixed acid, *spent. See* **Nitrating acid mixtures,** *spent*				
	Molybdenum pentachloride	8	2508	73.244	73.245b
	Monochlorodifluoromethane. *See* **Chlorodifluoromethane**				
	Monochloropentafluoroethane. *See* **Chloropentafluoroethane**				
	Monochlorotetrafluoroethane. *See* **Chlorotetrafluoroethane**				
	Monochlorotrifluoromethane. *See* **Chlorotrifluoromethane**				
	Monoethanolamine. *See* **Ethanolamine** *and solutions thereof*				
	Monoethylamine. *See* **Ethylamine**				
	Monoethylamine, *solution. See* **Ethylamine,** *solution*				
	Monopropylamine	3.1	1277	None	73.119
	Morpholine	3.3	2054	73.118a	None
S	**Motor fuel anit-knock mixtures**	6.1	1649	None	73.354
	Motor fuel, n.o.s.	3.1	1203	73.118	73.119
	Motor spirit. *See* **Gasoline**				
	Muriatic acid. *See* **Hydrochloric acid**				
	Naphtha	3.1	2553	73.118	73.119
		3.2	2553	73.118	73.119
		3.3	2553	73.118a	None
	Naphthalene, *crude or refined*	4.1	1334	73.153	73.154
	Naphtha, *petroleum*	3.1	1255	73.118	73.119
		3.2	1255	73.118	73.119
		3.3	1255	73.118a	None
	Naphtha, *solvent*	3.1	1256	73.118	73.119
		3.2	1256	73.118	73.119
		3.3	1256	73.118a	None
	Naphthylamine *(beta)*	6.1	1650	73.364	73.365
	alpha-Naphthylthiourea	6.1	1651	73.364	73.365
	Naphthylurea	6.1	1652	73.364	73.365
	Naphthalene, *molten*	4.1	2304	73.153	73.154
	Natural gases *with high methane content. See* **Methane** *or* **natural gases,** *etc.*				
	Natural gasoline. *See* **Casinghead gasoline**				
	Neohexane. *See* **dimethyl butane**				
	Neon *compressed*	2.2	1065	73.306	73.302
	Neon, *liquid*	2.2	1913	73.306 73.307	73.302 73.304 73.305
S	**Nickel carbonyl**	6.1	1259	None	73.126
	Nickel catalyst, *dry*	4.2	2881	73.153	73.154

(1) Notes	(2) Commodities	(3) Class	(4) Identification Number	(5) Packaging (a) Exemptions	(5) Packaging (b) Specific Requirements
	Nickel catalyst, *finely divided, activated or spent, wetted with not less than 40% of water or other suitable liquid*	4.2	1378	None	73.233
	Nickel cyanide	6.1	1653	73.370	73.370
	Nickel nitrate	5.1	2725	73.153	73.182
	Nickel nitrite	5.1	2726	73.153	73.154
S	**Nicotine**	6.1	1654	None	73.346
S	**Nicotine,** *(compounds and preparations),* **n.o.s.**	6.1	1655	73.345	73.346
S	**Nicotine hydrochloride,** *and solutions*	6.1	1656	73.345	73.346
S	**Nicotine salicylate**	6.1	1657	73.364	73.365
S	**Nicotine sulphate,** *solid or solution*	6.1	1658	73.345 73.364	73.346 73.365
S	**Nicotine tartrate**	6.1	1659	73.364	73.365
	Nitrate of soda and potash, *mixture. See* **Sodium nitrate and potash,** *mixture*				
	Nitrates, *(inorganic),* **n.o.s.**	5.1	1477	73.153	73.182
	Nitrating acid mixtures	8	1796	None	73.267
	Nitrating acid mixtures, *spent*	8	1826	None	73.248
	Nitric acid, *other than red fuming, all concentrations*	8	2031	None	73.268
S	**Nitric acid,** *red fuming*	8	2032	None	73.268
S	**Nitric oxide**	2.3	1660	None	73.337
S	**Nitric oxide and nitrogen tetroxide,** *mixtures*	2.3	1975	None	73.338
	Nitrites, *inorganic,* **n.o.s.**	5.1	2627	73.153	73.154
	Nitroanilines	6.1	1661	73.364	73.373
	Nitrobenzene	6.1	1662	73.345	73.346
	Nitrobenzenesulphonic acid	8	2305	73.244	73.245 73.245a
	Nitrobenzol. *See* **Nitrobenzene**				
S	**5-Nitrobenzotriazol**	1.1	0385	None	73.61
	Nitrobenzotrifluoride	6.1	2306	73.345	73.346
	Nitrocellulose, *with alcohol, more than 25% alcohol, by weight and not exceeding 12.6% nitrogen by dry weight*	4.1	2556	73.118	73.127
	Nitrocellulose, *with water, more than 25% water, by weight*	4.1	2555	73.153	73.184
	Nitrocellulose, *containing at least 18% plasticizing substance, by weight, and not exceeding 12.6% nitrogen by dry weight*	4.1	2557	73.153	73.184
S	**Nitrocellulose,** *dry or wetted with less than 25% water or alcohol, by weight*	1.1	0340	None	73.61
	Nitrocellulose solutions, *flammable with not more than 12.6% nitrogen, by weight and more than 55% nitrocellulose*	3.2 3.3	2059 2060	73.118 73.118a	73.119 None
	Nitrocellulose, *wetted with, by weight, more than 40% flammable liquids*	3.2 3.3	2556 2556	73.118 73.118a	73.127 None
S	**Nitrocellulose** *with less than 18% plasticizing substance, by weight*	1.1	0341	None	73.61
	Nitrocellulose *with not less than 25% alcohol, by weight*	1.3	0342	None	73.61
	Nitrocellulose *with not less than 18% plasticizing substance, by weight*	1.3	0343	None	73.61
	3-Nitro-4-chlorobenzotrifluoride	6.1	2307	73.345	73.346
	Nitroethane	3.3	2842	73.118a	None
	Nitrogen, *compressed*	2.2	1066	73.306	73.302
S	**Nitrogen dioxide**	2.3	1067	None	73.336
	Nitrogen, *liquid*	2.2	1977	None	73.304 73.314
	Nitrogen tetroxide. *See* **Nitrogen dioxide**				
S	**Nitrogen trifluoride**	2.3	2451	None	73.302
S	**Nitrogen trioxide**	2.3	2421	None	73.328
S	**Nitroglycerine, desensitized,** *containing, by weight, at least 40% non-volatile water-insoluble phlegmatizer*	1.1	0143	None	73.62
S	**Nitroglycerine, spirit of,** *containing, more than 1% but not more than 10% nitroglycerine in solution*	1.1	0144	None	73.62
	Nitroglycerine solution, *up to 1% in alcohol. See* **Glyceryl trinitrate,** *solution*				
S	**Nitroguanidine,** *dry or containing, by weight less than 20% water*	1.1	0282	None	73.61
	Nitroguanidine, *wetted with not less than 20% of water*	4.1	1336	73.153	73.184
	Nitrohydrochloric acid	8	1798	None	73.278
	Nitromethane	3.3	1261	None	73.149a
	Nitromuriatic acid. *See* **Nitrohydrochloric acid**				
	Nitronaphthalene	4.1	2538	73.153	73.154
	Nitropropanes	3.3	2608	73.118a	None
	p-Nitrosodimethylaniline	4.2	1369	73.153	73.154
S	**Nitrostarch,** *dry or containing, by weight, less than 20% water*	1.1	0146	None	73.61
	Nitrostarch, *wetted with not less than 20% of water*	4.1	1337	73.153	73.184
S	**Nitrosyl chloride**	2.4	1069	None	73.304 73.314
	Nitrosylsulphuric acid	8	2308	73.244	73.245b
S	**Nitrotoluenes (o-,m-,p-)**	6.1	1664	73.345	73.346
S	**Nitro urea**	1.1	0147	None	73.61
S	**Nitrous oxide**	2.2	1070	73.306	73.304 73.315
S	**Nitrous oxide,** *refrigerated liquid*	2.2	2201	73.306	73.304 73.315
	Nitroxylenes (o-,m-,p-)	6.1	1665	73.345	73.346
	Nonane	3.3	1920	73.118a	None
	Di-n-nonanoyl peroxide *or* **pelargonyl peroxide,** *technically pure*	5.2	2130	73.153	73.154
	Nonyl trichlorosilane	8	1799	None	73.280
	Octadecyl trichlorosilane	8	1800	None	73.280
	Octadiene	3.2	2309	73.118	73.119
	Octafluorobut-2-ene	2.2	2422	73.306	73.304

(1) Notes	(2) Commodities	(3) Class	(4) Identification Number	(5) Packaging (a) Exemptions	(5) Packaging (b) Specific Requirements
	Octafluorocyclobutane	2.2	1976	73.306 73.307	73.302 73.304 73.305
	Octafluoropropane	2.2	2424	73.306	73.304
	di-n-octanoyl peroxide. *See* **n-octanoyl peroxide**				
	Octane *and its isomers*	3.2	1262	73.118	73.119
	n-Octanoyl peroxide, *technical pure*	5.2	2129	73.153	73.221
S	**Octolite,** *dry or containing, by weight less than 15% water*	1.1	0266	None	73.61
	Octyl aldehydes. *See* **Ethyl hexaldehyde**				
	Octyl trichlorosilane	8	1801	None	73.280
S	**Oil gas**	2.1	1071	73.306	73.302 73.304 73.305
	Oleum. *See* **Sulphuric acid,** *fuming*				
	Organic peroxides, mixture *(this description must be supplemented with the name of the primary constituent of the mixture)*	5.2	2756	73.153	73.221
	Organic peroxides, n.o.s.	5.2	2255	73.153	73.154 73.221
	Organic peroxides, *trial quanitites,* **n.o.s.**	5.2	2899	73.153	73.154
	Organic phosphate compound *or* **Organic phosphorus compound,** *liquid or mixtures, liquid*	6.1	3018	None	73.358 73.359
	Organic phosphate compound mixture *or* **Organic phosphorus compound mixture,** *solid or dry*	6.1	2783	73.377	73.377
	Organochlorine pesticides, *liquid, flammable, toxic,* **n.o.s.,** *flash point less than 23°C*	3.2	2762	73.118	73.119
	Organochlorine pesticides, *liquid, toxic, flammable,* **n.o.s.,** *flash point not less than 23°C*	6.1	2995	73.345	73.346
	Organochlorine pesticides, *liquid toxic,* **n.o.s.**	6.1	2996	73.345	73.346
	Organochlorine pesticides, *solid, toxic,* **n.o.s.**	6.1	2761	73.364	73.365
	Organophosphorus pesticides, *liquid, flammable, toxic,* **n.o.s.,** *flash point less than 23°C*	3.2	2784	73.118	73.119
	Organophosphorus pesticides, *liquid, toxic, flammable,* **n.o.s.,** *flash point not less than 23°C*	6.1	3017	73.345	73.346
	Organophosphorus pesticides, *liquid, toxic,* **n.o.s.**	6.1	3018	73.345	73.346
	Organophosphorus pesticides, *solid, toxic,* **n.o.s.**	6.1	2783	73.364	73.365
	Organotin compounds, n.o.s.	6.1	2788	73.364	73.365
	Organotin pesticides, *liquid, flammable, toxic,* **n.o.s.,** *flash point less than 23°C*	3.2	2787	73.118	73.119
	Organotin pesticides, *liquid, toxic, flammable,* **n.o.s.,** *flash point not less than 23°C*	6.1	3019	73.345	73.346
	Organotin pesticides, *liquid, toxic,* **n.o.s.**	6.1	3020	73.345	73.346
	Organotin pesticides, *solid, toxic,* **n.o.s.**	6.1	2786	73.364	73.365
S	**Osmium tetroxide**	6.1	2471	73.364	73.365
	Oxidizing substances, n.o.s.	5.1	1479	73.153	73.154
	Oxygen and carbon dioxide, *mixtures. See* **Carbon dioxide and oxygen** *mixtures*				
	Oxygen, *compressed*	2.2	1072	73.306	73.302
S	**Oxygen difluoride**	2.3	2190	None	73.328
S	**Oxygen,** *liquid*	2.2	1073	None	73.304 73.314
	Paint, enamel, lacquer, stain, shellac, varnish, pollish, filler (liquid).	3.2	1263	73.118	73.128
	lacquer base and thinner *(not including substances containing nitrocellulose for which See* **Nitrocellulose.)**	3.3	1263	73.118a	None
	Paper, *treated with unsaturated oils, incompletely dried*	4.2	1379	None	73.154
	Paraformaldehyde	4.1	2213	73.153	73.154
	Paraldehyde	3.3	1264	73.118a	None
	Parathion, *liquid, or mixtures, liquid*	6.1	3018	None	73.358
	Parathion, *mixture, dry*	6.1	2783	73.377	73.377
S	**Pentaborane**	4.2	1380	None	73.138
	Pentachloroethane	6.1	1669	73.345	73.346
S	**Pentaerythrite tetranitrate,** *or* **P.E.T.N.** *containing, by weight, at least 25% water or at least 15% phlegmatizer*	1.1	0150	None	73.77
S	**Pentaerythrite tetranitrate** *or* **P.E.T.N.** *with not less than 7% wax by weight*	1.1	0411	None	73.77
	Pentamethylheptane. *See* **Isododecane**				
	3-pentanol	3.3	2706	73.118a	None
	Pentane	3.1	1265	73.118	73.119
	2,4-Pentanedione	3.3	2310	73.118a	None
	1-Pentol	8	2705	73.244	723.245
S	**Pentolite,** *dry or containing, by weight, less than 15% water*	1.1	0151	None	73.61
	Peracetic acid. *See* **Peroxyacetic acid**				
S	**Perchlorates,** *(inorganic),* **n.o.s.**	5.1	1481	73.153	73.154
S	**Perchloric acid,** *not exceeding 50%, by weight of acid*	8	1802	73.244	73.269
S	**Perchloric acid,** *over 50% and not exceeding 72% of acid*	5.1	1873	None	73.269
S	**Perchloromethyl-mercaptan**	6.1	1670	73.345	73.360
	Perfumery products, *flammable liquid*	3.2 3.3	1266 1266	73.118 73.118a	73.119 None
	Permanganates, *(inorganic),* **n.o.s.**	5.1	1482	73.153	73.154
	Peroxides, *inorganic,* **n.o.s.**	5.1	1483	73.153	73.154
	Peroxyacetic acid *in a mixture of acid and water, with not more than 6% hydrogen peroxide and not more than 1% sulphuric acid, or* **Peroxyacetic acid,** *not more than 43% in acetic acid*	5.2	2131	73.223	73.223
	Pesticides, *solid, toxic,* **n.o.s.**	6.1	2588	73.364	73.365
	Pesticides, *liquid, flammable, toxic,* **n.o.s.,** *flash point less than 23°C*	3.2	3021	73.118	73.119
	Pesticides, *liquid, toxic, flammable,***n.o.s.,** *flash point not less than 23°C*	6.1	2903	73.345	73.346
	Pesticides, *liquid, toxic,* **n.o.s.**	6.1	2902	73.345	73.346
	Petroleum crude oil	3.1 3.2 3.3	1267 1267 1267	73.118 73.118 73.118a	73.119 73.119 None

(1) Notes	(2) Commodities	(3) Class	(4) Identification Number	(5) Packaging (a) Exemptions	(5) Packaging (b) Specific Requirements
	Petroleum distillates, n.o.s.	3.1	1268	73.118	73.119
		3.2	1268	73.118	73.119
		3.3	1268	73.118a	None
	Petroleum ether. *See* **Petroleum spirit**				
S	**Petroleum gases,** *liquefied*	2.1	1075	73.306	73.304
					73.314
					73.315
	Petroleum oil	3.1	1270	73.118	73.119
		3.2	1270	73.118	73.119
		3.3	1270	73.118a	None
	Petroleum spirit	3.1	1271	73.118	73.119
		3.2	1271	73.118	73.119
		3.3	1271	73.118a	None
	Petrol. *See* **Gasoline**				
	Phenacyl bromide	6.1	2645	73.345	73.346
S	**Phenol**	6.1	1671	73.364	73.369
	Phenol, *molten*	6.1	2312	73.345	73.346
	Phenol, *solutions*	6.1	2821	73.345	73.349
	Phenolsulphonic acid, *liquid*	8	1803	73.244	73.245
					73.245a
	Phenoxy pesticides, *liquid, flammable, toxic,* **n.o.s.,** *flash point less than 23°C*	3.2	2766	73.118	73.119
	Phenoxy pesticides, *liquid, toxic, flammable,* **n.o.s.,** *flash point not less than 23°C*	6.1	2999	73.345	73.346
	Phenoxy pesticides, *liquid, toxic,* **n.o.s.**	6.1	3000	73.345	73.346
	Phenoxy pesticides, *solid, toxic,* **n.o.s.**	6.1	2765	73.364	73.365
	Phenylacetyl chloride	8	2577	73.244	73.245
S	**Phenylcarbylamine chloride**	6.1	1672	73.345	73.346
	Phenylchloroformate	6.1	2746	73.345	73.346
	Phenyldichloroarsine	6.1	1556	None	73.355
S	**Phenylhydrazine**	6.1	2572	73.364	73.365
	Phenyl isocyanate	6.1	2487	73.345	73.346
	Phenyl mercaptan	6.1	2337	73.118	73.119
	Phenylmercuric acetate	6.1	1674	73.364	73.365
S	**Phenylmercuric compounds, n.o.s.**	6.1	2026	73.364	73.365
	Phenylmercuric hydroxide	6.1	1894	73.364	73.365
	Phenylmercuric nitrate	6.1	1895	73.364	73.365
	Phenyl phosphorus dichloride	8	2798	None	73.250a
	Phenyl phosphorus thiodichloride	8	2799	None	73.250a
	Phenyl trichlorosilane	8	1804	None	73.280
	Phenyl urea pesticides, *liquid, flammable, toxic,* **n.o.s.,** *flash point less than 23°C*	3.2	2768	73.118	73.119
	Phenyl urea pesticides, *liquid, toxic, flammable,* **n.o.s.,** *flash point not less than 23°C*	6.1	3001	73.345	73.346
	Phenyl urea pesticides, *liquid, toxic,* **n.o.s.**	6.1	3002	73.345	73.346
	Phenyl urea pesticides, *solid, toxic,* **n.o.s.**	6.1	2767	73.364	73.365
S	**Phosgene**	2.3	1076	None	73.333
	9-Phosphabicyclononanes, *or* **cyclooctadiene phosphines**	4.2	2940	73.153	73.154
S	**Phosphine**	2.3	2199	None	73.328
	Phosphoric acid, *liquid*	8	1805	73.244	73.245
	Phosphoric acid, solid	8	1805	73.244	73.245
					73.245b
	Phosphoric anhydride. *See* **Phosphorus pentoxide**				
	Phosphorus acid, *ortho*	8	2834	73.244	73.245b
	Phosphorus bromide. *See* **Phosphorus tribromide**				
	Phosphorus chloride. *See* **Phosphorus trichloride**				
	Phosphorus, *amorphous*	4.1	1338	None	73.189
	Phosphorus heptasulphide, *free from yellow or white phosphorus*	4.1	1339	None	73.225
	Phosphorus oxybromide	8	1939	None	73.271
	Phosphorus oxybromide, *molten*	8	2576	None	73.271
	Phosphorus oxychloride	8	1810	None	73.271
	Phosphorus pentabromide	8	2691	73.244	73.245b
	Phosphorus pentachloride	8	1806	None	73.191
S	**Phosphorus pentafluoride**	2.3	2198	None	73.328
	Phosphorus pentasulphide, *free from yellow or white phosphorus*	4.1	1340	None	73.225
	Phosphorus pentoxide	8	1807	None	73.188
	Phosphorus sesquisulphide, *free from yellow or white phosphorus*	4.1	1341	None	73.225
	Phosphorus tribromide	8	1808	None	73.270
	Phosphorus trichloride	8	1809	None	73.271
	Phosphorus trioxide	8	2578	73.244	73.245b
	Phosphorus trisulphide, *free from yellow or white phosphorus*	4.1	1343	None	73.225
	Phosphorus white, *molten*	4.2	2447	None	73.190
S	**Phosphorus, white or yellow,** *dry*	4.2	1381	None	73.190
S	**Phosphorus, white or yellow,** *under water*	4.2	1381	None	73.190
S	**Photo-flash powder** *in units*	1.1	0094	None	73.54
S	**Photo-flash powder** *in units*	1.2	0096	None	73.54
	Photo-flash powder *in units*	1.3	0305	None	73.91
	Phthalic anhydride, *dust, powder or molten liquid*	8	2214	73.244	73.245b
	Phthalimide derivative pesticides, *liquid, flammable, toxic,* **n.o.s.,** *flash point less than 23°C*	3.2	2774	73.118	73.119
	Phthalimide derivative pesticides, *liquid, toxic, flammable,* **n.o.s.,** *flash point not less than 23°C*	6.1	3007	73.345	73.346
	Phthalimide derivative pesticides, *liquid, toxic,* **n.o.s.**	6.1	3008	73.345	73.346
	Phthalimide derivative pesticides, *solid, toxic,* **n.o.s.**	6.1	2773	73.364	73.365
	Picolines	3.3	2313	73.118a	None
	Picric acid, *wetted with not less than 30% of water*	4.1	1344	73.192	73.193

(1) Notes	(2) Commodities	(3) Class	(4) Identification Number	(5) Packaging (a) Exemptions	(5) Packaging (b) Specific Requirements
	Picrite. *See* **Nitroguanidine**				
	Pinane hyroperoxide, *technical pure*	5.2	2162	73.153	73.224
	alpha-Pinene	3.3	2368	73.118a	None
	Pine oil	3.2	1272	73.118	73.119
		3.3	1272	73.118a	None
	Piperazine	8	2579	73.244	73.245b
	Piperidine	3.2	2401	73.118	73.119
	Plastics moulding materials *evolving flammable vapours*	9	2211	73.386	None
	Plastics, *(spontaneously combustible),* **n.o.s.**	4.2	2006	73.153	73.154
	Poisonous liquids, corrosive, n.o.s.	6.1	2927	73.345	73.346
	Poisonous liquids, flammable, n.o.s.	6.1	2929	73.345	73.346
S	**Poisonous liquids, n.o.s.**	6.1	2810	73.345	73.346
	Poisonous solids, corrosive, n.o.s.	6.1	2928	73.364	73.365
	Poisonous solids, flammable, n.o.s.	6.1	2930	73.364	73.365
S	**Poisonous solids, n.o.s.**	6.1	2811	73.364	73.365
	Polishes. *See* **Paints,** *etc.*				
	Polishing fluid. *See* **Flammable liquid preparations. n.o.s.**				
	Polystyrene beads, *expandable, containing flammable liquid. See* **Plastic moulding materials**				
S	**Potassium**	4.3	2257	None	73.206
	Potassium arsenate, *solid*	6.1	1677	73.364	73.365
	Potassium arsenite, *solid*	6.1	1678	73.364	73.365
	Potassium bifluoride, *solid*	8	1811	73.244	73.245b
	Potassium bifluoride, *solution*	8	1811	73.244	73.249
	Potassium borohydride	4.3	1870	73.153	73.154
	Potassium bromate	5.1	1484	73.153	73.154
	Potassium chlorate	5.1	1485	73.153	73.163
	Potassium chlorate, *aqueous solution*	5.1	2427	None	73.245
	Potassium cuprocyanide	6.1	1679	73.364	73.370
S	**Potassium cyanide**	6.1	1680	73.370	73.370
				73.345	73.352
	Potassium dithionite	4.2	1929	73.153	73.154
	Potassium fluoroacetate	6.1	2628	73.244	73.245b
	Potassium hydrogen fluoride. *See* **Potassium bifluoride,** *solution*				
	Potassium hydrogen sulphate	8	2509	73.244	73.245b
	Potassium hydrosulphite. *See* **Potassium dithionite**				
	Potassium hydroxide, *solid*	8	1813	73.244	73.245b
	Potassium hyroxide, *solution*	8	1814	73.244	73.249
	Potassium hypochlorite, *solution. See* **Hypochlorite,** *solutions, etc.*				
	Potassium, metal alloys	4.3	1420	None	73.202
	Potassium metavanadate	6.1	2864	73.364	73.365
	Potassium nitrate	5.1	1486	73.153	73.182
	Potassium nitrate and sodium nitrite, *mixture*	5.1	1487	73.153	73.183
	Potassium nitrate bags, *empty. See* **Bags,** *empty and unwashed, etc.*				
	Potassium nitrite	5.1	1488	73.153	73.154
	Potassium oxide	8	2033	73.244	73.245b
	Potassium perchlorate	5.1	1489	73.153	73.219
	Potassium permanganate	5.1	1490	73.153	73.154
					73.194
	Potassium peroxide	5.1	1491	None	73.187
	Potassium persulphate	5.1	1492	73.153	73.154
	Potassium phosphide	4.3	2012	73.153	73.154
	Potassium salts of nitro-aromatic derivatives, *explosive*	1.3	0158	None	73.61
	Potassium-sodium, *alloy*	4.3	1422	None	73.202
					73.206
	Potassium sulphide, *anhydrous or containing less than 30% water of crystallization*	4.2	1382	73.153	73.207
	Potassium sulphide, *hydrated, containing not less than 30% water of crystallization*	8	1847	73.244	73.245
					73.245a
	Potassium superoxide	5.1	2466	73.153	73.187
	Powder paste, *containing, by weight, at least 35% water*	1.3	0159	None	73.61
S	**Powder,** *smokeless*	1.1	0160	73.197a	73.61
	Powder, *smokeless*	1.3	0161	73.197a	73.93
	Primers, *cap type*	1.4	0378	None	73.107
	Primers, *cap type*	1.4	0044	None	73.107
S	**Primers,** *cap type*	1.1	0377	None	73.68
	Primers, *tubular*	1.4	0320	None	73.107
	Primers, *tubular*	1.4	0376	None	73.107
	Primers, *tubular*	1.3	0319	None	73.91
	Projectiles, *inert with tracer*	1.4	0345	None	73.89
	Projectiles, *inert with tracer*	1.3	0424	None	73.89
	Projectiles, *inert with tracer*	1.4	0425	None	73.89
S	**Projectiles,** *with burster or expelling charge*	1.2	0346	None	73.54
	Projectiles, *with burster or expelling charge*	1.4	0347	None	73.89
S	**Projectiles,** *with burster or expelling charge*	1.2	0426	None	73.54
	Projectiles, *with burster or expelling charge*	1.4	0427	None	73.89
S	**Projectiles,** *with bursting charge*	1.1	0168	None	73.54
S	**Projectiles,** *with bursting charge*	1.2	0169	None	73.54
	Projectiles, *with bursting charge*	1.4	0344	None	73.89
S	**Projectiles,** *with bursting charge*	1.1	0167	None	73.54
S	**Projectiles,** *with bursting charge*	1.2	0324	None	73.89
S	**Propadiene**	2.1	2200	73.306	73.304

(1) Notes	(2) Commodities	(3) Class	(4) Identification Number	(5) Packaging (a) Exemptions	(5) Packaging (b) Specific Requirements
S	**Propane**	2.1	1978	73.306	73.304 73.314 73.315
	Propanethiols	3.1	2402	73.118	73.141
		3.2	2402	73.118	73.141
	Propanol	3.2	1274	73.118	73.125
	Propionaldehyde	3.2	1275	73.118	73.119
	Propionic acid	8	1848	73.244	73.245
	Propionic anhydride	8	2496	73.244	73.245
	Propionitrile	3.2	2404	73.118	73.119
	Propionyl chloride	3.2	1815	73.244	73.245 73.245a
	Propionyl peroxide, *maximum concentration 28% in solution*	5.2	2132	73.153	73.221
	n-Propyl acetate	3.2	1276	73.118	73.119
	sec-Propyl alcohol. *See* **Isopropanol**				
	n-Propyl alcohol. *See* **Propanol**				
	Propylamine. *See* **Monopropylamine**				
	Propyl benzene	3.3	2364	73.118a	None
	Propyl chloride	3.1	1278	None	73.119
	n-Propyl chloroformate	3.3	2740	73.118a	None
S	**Propylene**	2.1	1077	73.306	73.302 73.304 73.314 73.315
	Propylene chlorohydrin	6.1	2611	73.345	73.346
	Propylene diamine	3.3	2258	73.118a	None
	Propylenediamine	3.2	2258	73.118	73.119
	Propylene dichloride	3.2	1279	73.118	73.119
	Propyleneimine, *inhibited*	3.2	1921	None	73.139
	Propylene oxide, *inhibited*	3.1	1280	73.118	73.119
	Propylene tetramer	3.3	2850	73.118a	None
	Propyl formates	3.2	1281	73.118	73.119
	n-Propyl isocyanate	3.2	2482	73.118	73.119
	n-Propyl nitrate	3.2	1865	73.118	73.119
	Propyl trichlorosilane	8	1816	None	73.280
	Pyridine	3.2	1282	73.118	73.119
	Pyrophoric liquids, n.o.s.	4.2	2845	None	73.134
S	**Pyrophoric metals, n.o.s.** *or* **pyrophoric alloys, n.o.s.**	4.2	1383	None	73.174
S	**Pyrophoric solids, n.o.s.**	4.2	2846	73.153	73.154
S	**Pyrosulphuryl chloride**	8	1817	73.244	73.247
	Pyroxylin. *See* **Nitrocellulose**				
	Pyrrolidine	3.2	1922	73.118	73.119
	Radioactive material, *articles manufactured from natural or depleted uranium or natural thorium*	7	2909	73.389	73.389
	Radioactive material, *empty packages*	7	2908	73.389	73.389
S	**Radioactive material, fissile, n.o.s.** *Class I, II or III*	7	2918	73.389	73.389
	Radioactive material, *instruments and articles*	7	2911	73.389	73.389
	Radioactive material, *limited quantity,* **n.o.s.**	7	2910	73.389	73.389
	Radioactive material, *low specific activity* **(LSA), n.o.s.**	7	2912	73.389	73.389
S	**Radioactive material, n.o.s.**	7	2982	73.389	73.389
S	**Radioactive material, special form, n.o.s.**	7	2974	73.389	73.389
	Rags, *oily*	4.2	1856	None	73.199
	Rare gases, *mixtures*	2.2	1979	73.306 73.307	73.302 73.304 73.305
	Rare gases, *mixtures with nitrogen*	2.2	1981	73.306 73.307	73.302 73.304 73.305
	Rare gases, *mixtures with oxygen*	2.2	1980	73.306	73.302
	Receptacles, *small, containing flammable compressed gas, not fitted with a dispersion device, not refillable*	2.1	2037	73.306	73.302 73.304 73.305
	Reducing liquid. *See* **Flammable liquid preparation, n.o.s.**				
S	**Refrigerant gases, n.o.s.**	2.1	1954	73.306	73.302 73.304 73.305
	Refrigerant gases, n.o.s.	2.2	1078	73.306 73.307	73.302 73.304 73.305
	Refrigerating machines, *containing non-flammable, non-poisonous, liquefied gases*	2.2	2857	73.306 73.307	None
	Release devices, *explosive*	1.4	0173	None	73.102
	Removing liquid. *See* **Flammable liquid preparations, n.o.s.**				
	Resin oil	3.2	1286	73.118	73.119
		3.3	1286	73.118a	None
	Resin solution	3.2	1866	73.118	73.119
		3.3	1866	73.118a	None
	Resin solution, *poisonous*	6.1	1896	73.345	73.346
	Rivets, *explosive*	1.4	0174	None	73.101 to 73.114

(1) Notes	(2) Commodities	(3) Class	(4) Identification Number	(5) Packaging (a) Exemptions	(5) Packaging (b) Specific Requirements
	Road asphalt, *liquid, tars or oil. See* **Cutbacks,** *asphalt or bitumen*				
S	**Rocket motors**	1.1	0280	73.238	73.79
S	**Rocket motors**	1.2	0281	73.238	73.79
	Rocket motors	1.3	0186	73.238	73.92
S	**Rocket motors,** *containing hypergolic liquids, with or without expelling charge*	1.2	0322	73.238	73.79
	Rocket motors, *containing hypergolic liquids, with or without expelling charge*	1.3	0250	73.238	73.95
S	**Rocket motors,** *liquid fuelled*	1.2	0395	73.238	73.95
	Rocket motors, *liquid fuelled*	1.3	0396	73.238	73.95
S	**Rockets,** *line throwing*	1.2	0238	None	73.79
	Rockets, *line throwing*	1.3	0240	None	73.92
S	**Rockets,** *liquid fuelled, with bursting charge*	1.1	0397	None	73.54
S	**Rockets,** *liquid fuelled, with bursting charge*	1.2	0398	None	73.54
S	**Rockets,** *with bursting charge*	1.1	0181	None	73.54
S	**Rockets,** *with bursting charge*	1.2	0182	None	73.54
S	**Rockets,** *with bursting charge*	1.1	0180	None	73.54
S	**Rockets,** *with bursting charge*	1.2	0295	None	73.54
	rockets, *with inert head*	1.3	0183	None	73.90
S	**Rodenticides, n.o.s.**	6.1	1681	73.345 73.364	73.346 73.365
		9	1681	73.386	None
	Rubber scrap *or* **rubber shoddy,** *powdered or granulated*	4.1	1345	73.153	73.201
	Rubber shoddy. *See* **Rubber scrap**				
	Rubber solution	3.2	1287	73.118	73.119
		3.3	1287	73.118a	None
	Rubidium hydroxide	8	2678	73.244	73.245b
	Rubidium hyroxide, *solution*	8	2677	73.244	73.245
	Rubidium	4.3	1423	None	73.206
	Samples, explosive, *other than initiating explosive*	1	0190	73.86	—
	Seed cake, *containing vegetable oil, solvent extractions containing not more than 1.5% of oil and 11% of moisture*	4.2	2217	73.153	73.154
	Seek cake, *with more than 1.5% oil and not more than 11% moisture*	4.2	1386	73.153	73.154
	Selenates *or* **selenites**	6.1	2630	73.364	73.365
	Selenic acid	8	1905	None	73.245
	Selenium disulphide	6.1	2657	73.364	73.365
S	**Selenium hexafluoride**	2.3	2194	None	73.328
	Selenium oxychloride	8	2879	73.244	73.245b
	Shale oil	3.2	1288	73.118	73.119
		3.3	1288	73.118a	None
	Shellac. *See* **Paints,** *etc.*				
	Signal devices, *hand*	1.4	0373	None	73.108
	Signal devices, *hand*	1.4	0191	None	73.108
S	**Signals, distress,** *ship (other than water-activated)*	1.1	0194	None	73.54
	Signals, distress, *ship (other than water-activated)*	1.3	0195	None	73.91
S	**Signals, railway track, explosive**	1.1	0192	None	73.61
	Signals, railway track, explosive	1.4	0193	None	73.91
S	**Signals, smoke,** *with explosive sound unit*	1.1	0196	None	73.54
S	**Signals, smoke,** *with explosive sound unit*	1.2	0313	None	73.54
	Signals, smoke, *without explosive sound unit*	1.4	0197	None	73.108
S	**Silane**	2.3	2203	None	73.302 73.304 73.305
	Silicon chloride. *See* **Silicon tetrachloride**				
	Silicon powder, *amorphous*	4.1	1346	73.153	73.154
	Silicon tetrachloride	8	1818	73.244	73.247
S	**Silicon tetrafluoride**	2.3	1859	73.306	73.302
	Silver arsenite	6.1	1683	73.364	73.365
S	**Silver cyanide**	6.1	1684	73.370	73.370
	Silver nitrate	5.1	1493	73.153	73.182
	Silver picrate, *wetted with not less than 30% water, by weight*	4.1	1347	73.153	73.154
	Sludge acid	8	1906	None	73.248
	Soda lime	8	1907	73.244	73.245b
	Sodium aluminate, *solid*	8	2812	73.244	73.245b
	Sodium aluminate, *solution*	8	1819	73.244	73.249
	Sodium aluminum hydride	4.3	2835	None	73.206
	Sodium amalgam	4.3	1424	73.153	73.154
	Sodium amide	4.3	1425	None	73.206
	Sodium-ammonium-vanadate	6.1	2863	73.364	73.365
	Sodium arsenate	6.1	1685	73.364	73.365 73.368
	Sodium arsenite, *aqueous solutions*	6.1	1686	73.345	73.346
	Sodium arsenite, *solid*	6.1	2027	73.364	73.365
	Sodium azide	6.1	1687	73.364	73.375
	Sodium bifluoride. *See* **Sodium hydrogen fluoride**				
	Sodium bisulphate, *solid. See* **Sodium hydrogen sulphate**				
	Sodium bisulphite, *solution. See* **Bisulphites,** *inorganic, aqueous solutions,* **n.o.s.**				
	Sodium borohydride	4.3	1426	73.153	73.154
	Sodium bromate	5.1	1494	73.153	73.154
	Sodium cacodylate	6.1	1688	73.364	73.365
	Sodium chlorate	5.1	1495	73.153	73.163
	Sodium chlorate, *aqueous solution*	5.1	2428	73.153	73.154 73.163

(1) Notes	(2) Commodities	(3) Class	(4) Identification Number	(5) Packaging (a) Exemptions	(5) Packaging (b) Specific Requirements
	Sodium chlorite	5.1	1496	None	73.160
	Sodium chlorite, *solution containing more than 5% available chlorine*	8	1908	73.244	73.263
S	**Sodium cuprocyanide,** *solid*	6.1	2316	73.364	73.365
S	**Sodium cuprocyanide,** *solution*	6.1	2317	73.345	73.346
S	**Sodium cyanide**	6.1	1689	73.370	73.370
				73.345	73.352
	Sodium dinitro-o-cresolate, *dry or containing, by weight, less than 15% water*	1.3	0234	None	73.61
	Sodium dinitro-o-cresolate, *wetted with not less than 15% of water*	4.1	1348	73.153	73.154
	Sodium dithionite	4.2	1384	73.153	73.204
	Sodium fluoroacetate	6.1	2629	73.364	73.365
	Sodium hydrate. *See* **Sodium hydroxide,** *solution*				
	Sodium hydride	4.3	1427	None	73.198
	Sodium hydrogen fluoride	8	2439	73.244	73.245b
	Sodium hydrogen sulphate, *solid*	8	1821	73.244	73.245b
	Sodium hydrogen sulphate, *solution*	8	2837	73.244	73.245
	Sodium hydrogen sulphite, *solution. See* **Bisulphites,** *inorganic, aqueous solutions, n.o.s.*				
	Sodium hydrosulphide	4.2	2318	73.153	73.154
	Sodium hydrosulphide, *with not less than 25% water of crystallization*	8	2949	73.244	73.245
	Sodium hydrosulphite	4.2	1384	73.153	73.204
	Sodium hydroxide, *solid*	8	1823	73.244	73.245b
	Sodium hydroxide, *solution*	8	1824	73.244	73.249
S	**Sodium,** *metal*	4.3	1428	None	73.206
S	**Sodium metal,** *dispersion in organic liquids*	4.3	1429	None	73.230
	Sodium methylate	4.3	1431	73.153	73.154
	Sodium methylate, *solutions in alcohol*	3.2	1289	73.118	73.119
		3.3	1289	73.118a	None
	Sodium monoxide	8	1825	73.244	73.245b
	Sodium nitrate	5.1	1498	73.153	73.182
	Sodium nitrate and potash, *mixture*	5.1	1478	73.153	73.182
	Sodium nitrate and potassium nitrate, *mixtures*	5.1	1499	73.153	73.154
	Sodium nitrate bags, *empty. See* **Bags,** *empty and unwashed, etc.*				
	Sodium nitrite	5.1	1500	73.153	73.234
S	**Sodium pentachlorophenate**	6.1	2567	73.364	73.365
	Sodium percarbonates	5.1	2467	73.153	73.154
	Sodium perchlorate	5.1	1502	73.153	73.154
	Sodium permanganate	5.1	1503	73.153	73.154
	Sodium peroxide	5.1	1504	None	73.187
	Sodium persulphate	5.1	1505	73.153	73.154
	Sodium phenolate, *solid*	8	2497	73.244	73.245b
	Sodium phosphide	4.3	1432	None	73.154
	Sodium picramate, *dry or containing, by weight, less than 20% water*	1.3	0235	None	73.61
	Sodium picramate, *wetted with not less than 20% of water*	4.1	1349	None	73.205
	Sodium-potassium, *alloy. See* **Potassium-sodium,** *alloy*				
	Sodium salts of aromatic nitro-derivatives, n.o.s., *explosive*	1.3	0203	None	73.61
	Sodium selenite	6.1	2630	73.364	73.365
	Sodium sulphide, *anhydrous or containing less than 30% water of crystallization*	4.2	1385	73.153	73.207
	Sodium sulphide, *hydrated, containing not less than 30% water of crystallization*	8	1849	73.244	73.245b
	Sodium superoxide	5.1	2547	73.153	73.187
S	**Sounding devices, explosive**	1.1	0374	None	73.54
S	**Sounding devices, explosive**	1.2	0375	None	73.54
S	**Sounding devices, explosive**	1.1	0296	None	73.54
S	**Sounding devices, explosive**	1.2	0204	None	73.54
	Squibs	1.4	0206	None	73.106
	Squibs	1.4	0422	None	73.106
	Squibs	1.4	0423	None	73.106
	Stains. *See* **Paints,** *etc.*				
	Stannic chloride, *anhydrous*	8	1827	73.244	73.247
	Stannic chloride, *pentahydrate*	8	2440	73.244	73.245b
	Stannic phosphides	4.3	1433	None	73.154
S	**Stibine**	2.3	2676	None	73.328
	Strike anywhere matches. *See* **Matches,** *strike anywhere*				
	Strontium alloys	4.3	1434	73.153	73.154
	Strontium arsenite	6.1	1691	73.364	73.365
	Strontium chlorate	5.1	1506	73.153	73.163
	Strontium nitrate	5.1	1507	73.153	73.182
	Strontium perchlorate	5.1	1508	73.153	73.154
	Strontium peroxide	5.1	1509	73.153	73.154
S	**Strontium phosphide**	4.3	2013	73.153	73.154
	Strontium, *powdered. See* **Pyrophoric metals**				
S	**Strychnine** *or* **strychnine salts**	6.1	1692	73.364	73.365
	Styrene monomer, *inhibited*	3.3	2055	73.118a	None
S	**Substances, explosive, n.o.s.**	1.1	0357	None	73.61
S	**Substances, explosive, n.o.s.**	1.2	0358	None	73.61
	Substances, explosive, n.o.s.	1.3	0359	None	73.91
	Substances *which in contact with water emit flammable gases,* **n.o.s.**	4.3	2813	73.153	73.154
	Substituted nitrophenol pesticides, *liquid flammable, toxic,* **n.o.s.,** *flash point less than 23°C*	3.2	2780	73.118	73.119
	Substituted nitrophenol pesticides, *liquid toxic, flammable,* **n.o.s.,** *flash point not less than 23°C*	6.1	3013	73.345	73.346
	Substituted nitrophenol pesticides, *liquid toxic, n.o.s.*	6.1	3014	73.345	73.346
	Substituted nitrophenol pesticides, *solid toxic,* **n.o.s.**	6.1	2779	73.364	73.365
	Succinic acid peroxide, *technical pure*	5.2	2135	73.153	73.158
	Sulphamic acid	8	2967	73.244	73.245b

(1) Notes	(2) Commodities	(3) Class	(4) Identification Number	(5) Packaging (a) Exemptions	(5) Packaging (b) Specific Requirements
	Sulphur chlorides	8	1828	None	173.247
	Sulphur dichloride. *See* **Sulphur chlorides**				
S	**Sulphur dioxide**	2.3	1079	173.306	173.304 173.314 173.315
	Sulphur hexafluoride	2.2	1080	173.306	173.304
	Sulphuric acid	8	1830	173.244	173.272
S	**Sulphuric acid,** *fuming*	8	1831	None	173.272
	Sulphuric acid, *spent*	8	1832	None	173.248
	Sulphuric anhydride. *See* **Sulphur trioxide,** *inhibited*				
	Sulphurous acid	8	1833	173.244	173.245
S	**Sulphur tetrafluoride**	2.3	2418	None	173.328
S	**Sulphur trioxide,** *inhibited*	8	1829	173.244	173.273
S	**Sulphuryl chloride**	8	1834	173.244	173.247
S	**Sulphuryl fluoride**	2.3	2191	173.306	173.304 173.314
	Tars, *liquid. See* **Cut-backs, asphalt** *or* **bitumen**				
S	**Tear gas candles,** *non-explosive*	6.1	1700	None	173.385
	Tear gas grenades, *non-explosive. See* **Tear gas candles**				
S	**Tear gas,** *(irritating substances, liquid or solid),* **n.o.s.**	6.1	1693	173.345 173.364	173.346 173.365
S	**Tellurium hexafluoride**	2.3	2195	None	173.328
	T.E.L. *See* **Motor fuel anti-knock mixtures**				
	Terpene hydrocarbons n.o.s.	3.3	2319	173.118a	None
	Terpinolene	3.3	2541	173.118a	None
	tert-Octyl hydroperoxide, *See* **1,1,3,3-tetramethylbutyl hydroperoxide**				
	tert-Octyl peroxy-2-ethylhexanoate. *See* **1,1,3,3-tetramethylbutyl peroxy-2-ethyl hexanoate**				
	1,1,2,2-Tetrachloroethane	6.1	1702	173.345	173.346
	Tetraethyl dithiopyrophosphate, *liquid and mixtures*	6.1	1704	None	173.358 173.359
	Tetraethyl dithiopyrophosphate mixture, *dry*	6.1	1704	None	173.377
S	**Tetraethyl dithiopyrophosphate** *with gases, including solution and mixtures thereof*	2.3	1703	None	173.334
	Tetraethylenepentamine	8	2320	173.244	173.245 173.245a
	Tetraethyl lead. *See* **Motor fuel anti-knock mixtures**				
S	**Tetraethyl pyrophosphate and compressed gas,** *mixture*	2.3	1705	None	173.334
	Tetraethyl pyrophosphate, *liquid and mixture*	6.1	3018	None	173.358 173.359
	Tetraethyl pyrophosphate mixture, *dry*	6.1	2783	None	173.377
	Tetraethyl silicate	3.3	1292	173.118a	None
S	**Tetrafluoroethylene,** *inhibited*	2.1	1081	173.306	173.304
S	**Tetrafluorohydrazine**	2.3	–	None	173.328
	Tetrafluoromethane	2.2	1982	173.306 173.307	173.302 173.304 173.305
	1,2,3,6-Tetrahydrobenzaldehyde	8	2498	173.244	173.245
	Tetrahydrofuran	3.1	2056	None	173.119
	1,2,3,6-Tetrahydropyridine	3.2	2410	173.118	173.119
	Tetrahydrothiophene	3.2	2412	173.118	173.119
	Tetralin hydroperoxide, *technical pure*	5.2	2136	173.153	173.221
	Tetramethylammonium hydroxide	8	1835	173.244	173.245
	1,1,3,3-Tetramethyl butyl hydroperoxide *technical pure*	5.2	2160	173.153	173.221
	1,1,3,3-Tetramethyl butyl peroxy-2-ethyl hexanoate, *technical pure*	5.2	2161	173.153	173.221
	Tetramethylsilane	3.1	2749	173.118	173.119
S	**Tetranitro-aniline**	1.1	0207	None	173.61
S	**Tetranitromethane**	5.1	1510	None	173.203
	Tetrapropylorthotitanate	3.3	2413	173.118a	None
	Tetrazol-l-acetic acid	1.4	0407	None	173.61
	Textile waste, *(wet),* **n.o.s.**	4.2	1857	None	173.211
	Thallium chlorate	5.1	2573	173.153	173.154
	Thallium compounds, n.o.s.	6.1	1707	173.364	173.365
	Thallium nitrate	6.1	2727	173.364	173.182
	Thinners. *See* **Paints,** *etc.*				
	Thinning liquid. *See* **Flammable liquid preparations, n.o.s.**				
	Thioacetic acid	3.2	2436	173.118	173.119
	Thiocarbonyl chloride. *See* **Thiophosgene**				
	Thioglycol	6.1	2966	173.345	173.346
	Thioglycolic acid	8	1940	173.244	173.245
	Thionyl chloride	8	1836	None	173.247
	Thiophene	3.2	2414	173.118	173.119
S	**Thiophosgene**	6.1	2474	None	173.356
	Thiophosphoryl chloride	8	1837	None	173.271
	Thorium metal, *pyrophoric*	7	2975	173.389	173.389
	Thorium nitrate, *solid*	7	2976	173.389	173.389
	Tin chloride, *fuming. See* **Stannic chloride** *anhydrous*				
	Tinctures, *medicinal*	3.2	1293	173.118	173.119
	Tin tetrachloride. *See* **Stannic chloride,** *anhydrous*				
	Titanium hydride	4.1	1871	173.153	173.184
	Titanium powder, *dry (a) mechanically produced, particle size between 3 and 53 microns; (b) chemically produced, particle size betweren 10 and 840 microns*	4.2	2546	None	173.208

(1) Notes	(2) Commodities	(3) Class	(4) Identification Number	(5) Packaging (a) Exemptions	(5) Packaging (b) Specific Requirements
	Titanium powder, *with not less than 25% water (a visible excess of water must be present); (a) mechanically produced, particle size less than 53 microns; (b) chemically produced, particle size less than 840 microns*	4.1	1352	None	73.208
	Titamium sulphate solution, *containing not more than 45% sulphuric acid*	8	1760	73.244	73.297
	Titanium tetrachloride	8	1838	73.244	73.247
	Titanium trichloride	4.2	2441	73.153	73.154
	Titanium trichloride, mixtures	8	2869	73.244	73.245b
	Toe puffs, *nitrocellulose base*	4.1	1353	73.153	73.154
	Toluene	3.2	1294	73.118	73.119
S	**Toluene diisocyanate** (T.D.I.)	6.1	2078	73.345	73.346
	Toluidines	6.1	1708	73.345	73.346
S	**Torpedoes,** *with bursting charge*	1.1	0329	None	73.54
S	**Torpedoes,** *with bursting charge*	1.1	0330	None	73.54
	Tracers for ammunition	1.4	0306	None	73.108
	Tracers for ammunition	1.3	0212	None	73.91
	Triallylamine	3.3	2610	73.118a	None
	Triazine pesticides, *liquid, flammable, toxic,* **n.o.s.** *flash point less than 23°C*	3.2	2764	73.118	73.119
	Triazine pesticides, *liquid, toxic, flammable,* **n.o.s.** *flash point not less than 23°c*	6.1	2997	73.345	73.346
	Triazine pesticides, *liquid, toxic,* **n.o.s.**	6.1	2998	73.345	73.346
	Triazine pesticides, *solid, toxic,* **n.o.s.**	6.1	2763	73.364	73.365
	Tri-(l-aziridinyl)-phosphine oxide, *solution*	6.1	2501	73.244	73.299a
	Tributylamine	8	2542	73.244	73.245 73.245a
	Trichloroacetic acid, *solid*	8	1839	73.244	73.245b
	Trichloroacetic acid, *solutions,*	8	2564	73.244	73.245
	Trichloroacetyl chloride	8	2442	73.244	73.245 73.245a
	Trichlorobutene	6.1	2322	73.345	73.346
	Trichloroisocyanuric acid, *dry*	5.1	2468	73.153	73.217
	Trichlorosilane	4.3	1295	None	73.136
	Tricresylphosphate, *with more than 3% ortho isomer*	6.1	2574	73.345	73.346
	Triethylaluminium. *See* **Aluminium triethyl**				
	Triethylamine	3.2	1296	73.118	73.119
	Triethylenetetramine	8	2259	73.244	73.245 73.245a
	Triethyl phosphite	3.3	2323	73.118a	None
	Trifluoroacetic acid	8	2699	73.244	73.245
	Trifluorobromomethane. *See* **Bromotrifluoromethane**				
	Trifluorochloroethane	2.2	1983	73.306 73.307	73.302 73.304 73.305
S	**Trifluorochloroethylene**	2.1	1082	73.306	73.304 73.314
	Trifluorochloromethane. *See* **Chlorotrifluoromethane**				
S	**Trifluoroethane**	2.1	2035	73.306	73.302 73.304 73.305
	Trifluoromethane	2.2	1984	73.306 73.307	73.302 73.304 73.305
	3-Trifluoromethylaniline	6.1	2948	73.345	73.346
	Triisobutyl aluminium	4.2	1930	73.118	73.119
	Triisobutylene	3.3	2324	73.118a	None
	Triisocyanatoisocyanurate of isophorone-diisocyanate, *solution 70% by weight*	3.3	2906	73.118a	None
	Triisopropyl borate	3.3	2616	73.118a	None
	Trimethyl acetyl chloride	8	2438	73.244	73.247
	Trimethylaluminium. *See* **Aluminium trimethyl**				
S	**Trimethylamine,** *anhydrous*	2.1	1083	73.306	73.304 73.314 73.315
	Trimethylamine, *aqueous solutions containing not more than 50% trimethylamine, by weight*	3.2	1297	73.118	73.119
	1,3,5-Trimethylbenzene	3.3	2325	73.118a	None
	Trimethyl borate	3.2	2416	73.118	73.119
	Trimethylchlorosilane	3.2	1298	None	73.135
	Trimethylcyclohexylamine	8	2326	73.244	73.245 73.245a
	Trimethylhexamethylene diamine	8	2327	73.244	73.245 73.245a
	Trimethylhexamethylene diisocyanate	6.1	2328	73.345	73.346
	Trimethyl phosphite	3.3	2329	73.118a	None
S	**Trinitro-aniline**	1.1	0153	None	73.61
S	**Trinitroanisole**	1.1	0213	None	73.61
S	**Trinitrobenzene,** *dry or wetted with less than 30% water, by weight*	1.1	0214	None	73.61
S	**Trinitrobenzenesulfonic acid**	1.1	0386	None	73.61
	Trinitrobenzene, *wetted with not less than 30% water, by weight*	4.1	1354	73.212	73.212
S	**Trinitrobenzoic acid,** *dry or containing, by weight, less than 30% water*	1.1	0215	None	73.61
	Trinitrobenzoic acid, *wetted with not less than 30% water, by weight*	4.1	1355	73.192	73.193
S	**Trinitrochlorobenzene**	1.1	0155	None	73.61
S	**Trinitrofluorenone**	1.1	0387	None	73.61
S	**Trinitrometacresol**	1.1	0216	None	73.61
S	**Trinitronaphthalene**	1.1	0217	None	73.61

(1) Notes	(2) Commodities	(3) Class	(4) Identification Number	(5) Packaging (a) Exemptions	(5) Packaging (b) Specific Requirements
S	**Trinitrophenetole**	1.1	0218	None	73.61
S	**Trinitrophenol,** *dry or containing, by weight, less than 30% water*	1.1	0154	None	73.61
S	**Trinitrophenol,** *wetted. See* **Picric acid,** *wetted*				
S	**Trinitrophenylmethylnitramine**	1.1	0208	None	73.61
S	**Trinitroresorcinol,** *containing by weight, not less than 20% water or mixture of alcohol and water*	1.1	0394	None	73.61
S	**Trinitroresorcinol,** *dry, or containing, by weight, less than 20% water or mixture of alcohol and water*	1.1	0219	None	73.61
S	**Trinitrotoluene** *or* **T.N.T.,** *dry or containing by weight, less than 30% water*	1.1	0209	None	73.61
S	**Trinitrotoluene** *mixed iwth trinitobenzene and hexanitrostilbene*	1.1	0389	None	73.61
S	**Trinitrotoluene (T.N.T.) and trinitrobenzene mixture** *or* **trinitrotoluene (T.N.T.) and hexanitrostilbene mixture**	1.1	0388	None	73.61
	Trinitrotoluene, *wetted with not less than 30% of water*	4.1	1356	73.212	73.212
	Tripropyl aluminum	4.2	2718	73.163	73.164
	Tripropylamine	3.3	2260	73.118a	None
	Tripropylene	3.2	2057	73.118	73.119
		3.3	2057	73.118a	None
	Tris-(1-aziridinyl) phosphine oxide, *solution*	6.1	2501	73.244	73.299a
S	**Tritonal**	1.1	0390	None	73.61
S	**Tungsten hexafluoride**	2.3	2196	None	73.284
	Turpentine	3.3	1299	73.118a	None
	Turpentine substitute	3.2	1300	73.118	73.119
		3.3	1300	73.118a	None
	U.D.M.H. *See* **Dimethylhydrazine,** *unsymmetrical*				
	Undecane	3.3	2330	73.118a	None
S	**Uranium hexafluoride, fissile,** *containing more than 0.7% uranium-235*	7	2977	73.389	73.389
	Uranium hexafluoride, low specific activity *containing not more than 0.7% uranium-235*	7	2978	73.389	73.389
S	**Uranium metal,** *pyrophoric*	7	2979	73.389	73.389
	Uranium nitrate hexahydrate, *solution. See* **Uranyl nitrate hexahydrate,** *solution*				
	Uranium nitrate, *solid. See* **Uranyl nitrate,** *solid*				
	Uranyl nitrate hexahydrate, *solution*	7	2980	73.389	73.389
	Uranyl nitrate, *solid*	7	2981	73.389	73.389
	Urea hydrogen peroxide	5.1	1511	73.153	73.227
S	**Urea nitrate,** *dry or containing, by weight, less than 20% water*	1.1	0220	None	73.61
	Urea nitrate, *wetted with not less than 20% water, by weight*	4.1	1357	73.192	73.193
	Valeraldehyde	3.2	2058	73.118	73.119
	Valeryl chlorides	8	2502	73.244	73.245
	Vanadium oxitrichloride	8	2443	73.244	73.247a
	Vanadium pentoxide, *non-fused form*	6.1	2862	73.364	73.365
	Vanadium tetrachloride	8	2444	73.244	73.247a
	Vanadium trichloride	8	2475	73.244	73.245b
	Vanadium trioxide, *non-fused form*	6.1	2860	73.364	73.365
	Vanadyl sulphate	6.1	2931	73.364	73.365
	Varnish. *See* **Paints,** *etc.*				
	Vinyl acetate, *inhibited*	3.2	1301	73.118	73.119
S	**Vinyl bromide,** *inhibited*	2.1	1085	73.306	73.302 73.304 73.305
	Vinyl butyrate, *inhibited*	3.2	2838	73.118	73.119
S	**Vinyl chloride,** *inhibited*	2.1	1086	73.306	73.304 73.314 73.315
	Vinyl ethyl ether, *inhibited*	3.1	1302	None	73.119
S	**Vinyl fluoride,** *inhibited*	2.1	1860	73.306	73.304 73.314 73.315
	Vinylidene, *inhibited*	3.1	1303	73.118	73.119
	Vinyl isobutyl ether, *inhibited*	3.2	1304	73.118	73.119
S	**Vinyl methyl ether,** *inhibited*	2.1	1087	73.306	73.304 73.314
	Vinyl Toluenes *(mixed isomers), inhibited*	3.3	2618	73.118a	None
	Vinyl trichlorosilane, *inhibited*	3.2	1305	None	73.135
	Warheads, rocket, *with burster or expelling charge*	1.4	0370	None	73.54
	Warheads, rocket, *with burster or expelling charge*	1.4	0371	None	73.54
S	**Warheads, rocket,** *with bursting charge*	1.1	0286	None	73.54
S	**Warheads, rocket,** *with bursting charge*	1.2	0287	None	73.54
S	**Warheads, rocket,** *with bursting charge*	1.1	0369	None	73.54
S	**Warheads, torpedo,** *with bursting charge*	1.1	0221	None	73.54
	White asbestos. *See* **Asbestos, white**				
	White phosphorus, *dry. See* **Phosphorus, white** *or* **yellow,** *dry*				
	White phosphorus, *wet. See* **Phosphorus white** *or* **yellow,** *in water*				
	Wood alcohol. *See* **Methanol**				
	Wood preservatives, *liquid*	3.2	1306	73.118	73.119
		3.3	1306	73.118a	None
	Wool waste, *wet*	4.2	1387	None	73.213
	Xenon	2.2	2036	73.306	73.302
	Xenon, *refrigerated liquid*	2.2	2591	73.306	73.304
	Xylenes	3.2	1307	73.118	73.119
		3.3	1307	73.118a	None
S	**Xylenols**	6.1	2261	73.345	73.346
S	**Xylidines**	6.1	1711	73.345	73.346
	Xylols. *See* **Xylenes**				

(1) Notes	(2) Commodities	(3) Class	(4) Identification Number	(5) Packaging (a) Exemptions	(5) Packaging (b) Specific Requirements
S	**Xylyl bromide**	6.1	1701	None	73.328
	Yellow phosphorus, *dry. See* **Phosphorus, white** *or* **yellow, dry**				
	Yellow phosphorus, *wet. See* **Phosphorus, white** *or* **yellow,** *in water*				
	Zinc ammonium nitrite	5.1	1512	None	73.228
	Zinc arsenate and arsenite, *solid mixtures*	6.1	1712	73.364	73.365
	Zinc ashes	4.3	1435	73.153	73.154
	Zinc bromate	5.1	2469	73.153	73.154
	Zinc chlorate	5.1	1513	73.153	73.163
	Zinc, chloride, *anhdrous*	8	2331	73.244	73.245b
	Zinc chloride, *solution*	8	1840	73.244	73.245
S	**Zinc cyanide**	6.1	1713	73.370	73.370
	Zinc dithionite	9	1931	73.386	None
	Zinc ethyl. *See* **Diethylzinc**				
	Zinc nitrate	5.1	1514	73.153	73.182
	Zinc permanganate	5.1	1515	73.153	73.154
	Zinc peroxide	5.1	1516	73.153	73.154
S	**Zinc phosphide**	4.3	1714	73.364	73.365
	Zinc, powder *or* **zinc dust**	4.3	1436	73.153	73.154
	Zinc, *powder or dust, pyrophoric. See* **Pyrophoric metals**				
	Zinc resinate	4.1	2714	73.153	73.154
	Zirconium, dry, *coiled wire, finished metal sheets, strip (thinner than 254 microns but not thinner than 18 microns)*	4.1	2858	73.153	73.154
	Zirconium, dry, *finished sheets, strip or coiled wire*	4.2	2009	73.153	73.154
	Zirconium hydride	4.1	1437	None	73.206
	Zirconium metal powder, *wet with not less than 25% water (a visible excess of water must be present)*	4.1	1358	None	73.214
	Zirconium nitrate	5.1	2728	73.153	73.182
	Zirconium picramate, *dry or containing, by weight, less than 20% water*	1.3	0236	None	73.61
	Zirconium picramate, *wetted with not less than 20% of water*	5.1	1517	None	73.216
	Zirconium powder, dry *(a) mechanically produced, particle size between 3 and 53 microns (b) chemically produced, particle size between 10 and 840 microns*	4.2	2008	None	73.214
	Zirconium, *scrap*	4.2	1932	73.153	73.220
	Zirconium, *suspended in flammable liquid*	3.1	1308	None	73.140
	Zirconium tetrachloride	8	2503	73.244	73.245b

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73.205 Sodium picramate, wet.
73.206 Sodium or potassium metallic, sodium amide, sodium or potassium alloys, lithium metal, lithium silicon, lithium ferro silicon, lithium hydride, lithium aluminum hydride, rubidium metal, zirconium hydride and alkaline earth metal amalgams, n.o.s.
73.207 Sodium sulphide or potassium sulphide, fused or concentrated, when ground.
73.208 Titanium metal powder, wet or dry.
73.211 Textile waste, wet.
73.212 Trinitrobenzene and trinitrotoluene, wet.
73.214 Hafnium metal or zirconium metal, wet.
73.216 Zirconium picramate, wet.
73.217 Calcium hypochlorite, hydrated, calcium hypochlorite mixture, dry, lithium hypochlorite mixture, dry. dichloroisocyanuric acid, dry, dichloroisocyanuric acid salts of potassium and sodium, dry and trichloroisocyanuric acid, dry.
73.219 Potassium perchlorate.
73.220 Magnesium or zirconium scrap consisting of borings, clippings, shavings, sheets, turnings, or scalpings, and magnesium metallic (other than scrap), powdered, pellets, turnings, or ribbon.
73.221 Liquid organic peroxides, n.o.s., and liquid organic peroxide solutions, n.o.s.
73.222 Acetyl peroxide and acetyl benzoyl peroxide, solution.
73.223 Peracetic acid.
73.224 Cumene hydroperoxide, dicumyl peroxide, diisopropylbenzene hydroperoxide, paramenthane hydroperoxide, and pinane hydroperoxide.
73.225 Phosphorus sesquisulphide, phosphorus pentasulphide, phosphorous heptasulphide, and phosphorous trisulphide.
73.227 Urea hydrogen peroxide.
73.228 Zinc ammonium nitrite.
73.229 Chlorate and borate mixtures or chlorate and magnesium chloride mixtures.
73.230 Sodium, metallic, dispersion in organic solvent.
73.231 Calcium, metallic, crystalline.
73.232 Tank cars containing residual phosphorus.
73.233 Nickel catalyst, finely divided, activated or spent.
73.234 Sodium nitrite and sodium nitrite mixtures.
73.235 Ammonium bichromate (ammonium dichromate).
73.236 Decaborane.
73.238 Aircraft rocket engines (commercial) and/or aircraft rocket engine igniters (commercial).
73.239 Barium azide — 50 per cent or more water wet.
73.239a Ammonium perchlorate.

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Subpart E — Corrosives

73.241 Outage.
73.242 Bottles containing corrosive liquids.
73.243 Closing and cushioning.
73.244 Exemptions for corrosive materials.
73.245 Corrosive liquids not specifically provided for.
73.245a Corrosive liquids, n.o.s. shipped in bulk.
73.245b Corrosive solids not specifically provided for.
73.246 Antimony pentafluoride, iodine pentafluoride, bromine pentafluoride, bromine trifluoride and chlorine trifluoride.
73.247 Acetyl bromide, acetyl chloride, antimony penta chloride, bensoyl chloride, boron trifluoride-acetic acid complex, chromium oxychloride, dichlora cetyl chloride, pyrosulphuryl chloride, silicon tetrachloride, sulphur chloride (mono and di), sulphuryl chloride, thionyl chloride, stannic chloride (anhydrous), titanium tetrachloride, acetyl iodide and trimethyl acetyl chloride.
73.247a Vanadium tetrachloride and vanadium oxytri chloride.
73.248 Sludge acid, spent sulphuric acid, or spent mixed acid.
73.249 Alkaline corrosive liquids, n.o.s., alkaline caustic liquids, n.o.s., alkaline corrosive battery fluids, potassium hydrogen fluoride solution, sodium hydroxide solution, potassium hydroxide solution and sodium aluminate, liquid.
73.249a Dye intermediates, liquid, n.o.s.
73.250 Automobiles or other self-propelled vehicles, engines or other mechanical apparatus.
73.250a Phenyl phosphorus dichloride and phenyl phosphorus thiodichloride.
73.251 Boron trichloride and boron tribromide.
73.252 Bromine.
73.253 Chloracetyl chloride.
73.254 Chlorosulphonic acid and mixtures of Chlorosulphonic acid-Sulphur trioxide.
73.255 Dimethyl sulphate.
73.257 Battery fluid, acid or battery fluid, alkaline.
73.258 Battery fluid, acid or battery fluid, alkaline, packed with storage batteries.
73.259 Battery fluid, acid or battery fluid, alkaline,packed with battery charger, radio current supply device, or electronic equipment and actuating devices.
73.260 Electric storage batteries, wet.
73.261 Fire-extinguisher charges.
73.262 Hydrobromic acid.
73.263 Hydrochloric acid, hydrochloric acid solution, inhibited, hydrochloric acid mixtures and sodium chlorite solution not exceeding 42 per cent sodium chlorite.
73.264 Hydrofluoric acid.
73.265 Hydrofluosilic acid.
73.266 Hydrogen peroxide solution in water.
73.267 Nitrating acid mixtures.
73.268 Nitric acid.
73.269 Perchloric acid.
73.270 Phosphorus tribromide.
73.271 Phosphorus oxychloride, phosphorus oxybromide, phosphorus trichloride, and thiophosphoryl chloride.

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73.272 Sulphuric acid.
73.273 Sulphur trioxide, stabilized.
73.274 Fluosulphonic acid.
73.275 Difluorophosphoric acid, anhydrous, fluorophosphoric acid, anhydrous, hexafluorophosphoric acid, and mixtures thereof.
73.276 Anhydrous hydrazine and hydrazine solution.
73.277 Hypochlorite solutions.
73.278 Nitrohydrochloric acid.
73.279 Anisoyl chloride.
73.280 Allyl trichlorosilane, amyl trichlorosilane, butyl trichlorosilane, cyclohexenyl trichlorosilane, cyclohexyl trichlorosilane, dichlorophenyl trichlorosilane, diethyl dichlorosilane, diphenyl dichlorosilane, dodecyl trichlorosilane,ethyl phenyl dichlorosilane, hexadecyl trichlorosilane, hexyl trichlorosilane, nonyl trichlorosilane, octadecyl trichlorosilane, octyl trichlorosilane, phenyl trichlorosilane, propyltrichlorosilane and chlorophenyl trichlorosilane.
73.281 Benzyl bromide (bromotoluene, alpha).
73.283 Fluoboric acid.
73.284 Tungsten hexafluoride.
73.287 Chromic acid solution.
73.288 Allyl chloroformate, benzyl chloroformate, ethyl chloroformate, and methyl chloroformate.
73.289 Formic acid and formic acid solutions.
73.290 Mixtures of hydrofluoric and sulphuric acid.
73.292 Hexamethylene diamine solution.
73.293 Iodine monochloride.
73.294 Chloroacetic acid, liquid.
73.295 Benzyl chloride.
73.296 Di iso octyl acid phosphate.
73.297 Titanium sulphate solution containing not more than 45% sulphuric acid.
73.298 Memtetrahydro phthalic anhydride.
73.299 Etching acid liquid, n.o.s.
73.299a Tris- (1-aziridinyl) phosphine oxide.

Subpart F — Compressed and Refrigerated Gases

73.301 General requirements for shipment of compressed gases in cylinders.
73.302 Charging of cylinders with non-liquefied compressed gases.
73.303 Charging of cylinders with compressed gas in solution (acetylene).
73.304 Charging of cylinders with liquefied compressed gas.
73.305 Charging of cylinders with a mixture of compressed gas and other material.
73.306 Exemptions from compliance with regulations for shipping compressed gas.
73.307 Exceptions for compressed gases.
73.314 Requirements for compressed gases in tank cars.
73.315 Compressed gases in portable tank containers.
73.316 Liquefied hydrogen.

Subpart G — Poisonous Substances

73.327 Packing.
73.328 Poisonous gases and liquids not specifically provided for.
73.329 Bromacetone; chlorpicrin and methyl chloride mixtures; chlorpicrin and nonflammable, nonliquefied compressed gas mixtures.

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73.330 Chemical ammunition.
73.331 Gas identification sets.
73.332 Hydrocyanic acid, liquid (prussic acid) and hydrocyanic acid liquefied.
73.333 Phosgene or diphosgene.
73.334 Hexaethyl tetraphosphate, tetraethyl dithio pyrophosphate, tetraethyl pyrophosphate, or other poison organic phosphate mixtures, mixed with compressed gas.
73.336 Nitrogen dioxide, liquid; nitrogen peroxide, liquid; and nitrogen tetroxide, liquid.
73.337 Nitric oxide.
73.338 Nitrogen tetroxide-nitric oxide mixtures containing up to 33.2 percent weight nitric oxide.
73.344 Packaging for poisonous liquids, division 6.1.
73.345 Exemptions for poisonous liquids, division 6.1, packaging groups I & II.
73.346 Poisonous liquids not specifically provided for.
73.347 Aniline oil.
73.348 Arsenic acid.
73.349 Carbolic acid (phenol) liquid.
73.350 Chemical ammunition.
73.351 Hydrocyanic acid solutions.
73.352 Sodium and potassium cyanide solutions, and other cyanide solutions.
73.353 Methyl bromide, liquid, methyl bromide and ethylene dibromide, liquid mixtures and methyl bromide and chloropicrin, liquid mixtures.
73.354 Motor fuel antiknock mixture or tetraethyl lead.
73.355 Phenyldichlorarsine.
73.356 Thiophosgene.
73.357 Chloropicrin and chlorpicrin mixtures n.o.s. containing no compressed gas and poisonous liquids, Division 6.1, Packing Group I.
73.358 Hexaethyl tetraphosphate, methyl parathion, organic phosphate compound mixtures, parathion, tetraethyl dithio pyrophosphate and tetraethyl pyrophosphate, liquid.
73.359 Hexaethyl tetraphosphate mixtures, methyl parathion mixtures, organic phosphate compound mixtures, parathion mixtures, teraethyl dithio pyrophosphate mixtures, and tetraethyl pyrophosphate mixtures, liquid.
73.360 Perchloro-methyl-mercaptan.

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73.361 Aldrin mixtures, liquid, with more than 60 percent aldrin.
73.362 4-Chloro-o-toluidine hydrochloride.
73.362A Dinitrophenol solutions.
73.363 Packaging for poisonous solids, division 6.1.
73.364 Exemptions for poisonous solids, division 6.1, packaging groups I & II.
73.365 Poisonous solids not specifically provided for.
73.366 Arsenic (arsenic trioxide) or arsenic acid (solid).
73.367 Arsenic compounds, n.o.s., lead arsenates, calcium arsenate, copper acetoarsenite and arsenic, metallic.
73.368 Arsenical dust, arsenical flue dust, and other poisonous non-combustible by-product dusts; also arsenic trioxide, calcium arsenate, and sodium arsenate.
73.369 Carbolic acid (phenol), not liquid.
73.370 Cyanides, and mixtures, dry.
73.371 Dinitrobenzenes.
73.372 Mercury bichloride (mercuric chloride).
73.373 Ortho-nitroaniline and paranitraniline.
73.374 Chloronitrobenzene, meta or para.
73.375 Sodium azide.
73.376 Aldrin and aldrin mixtures, dry, with more than 65 per cent aldrin.
73.377 Hexaethyl tetraphosphate mixtures, methyl parathion mixtures, organic phosphate compound mixtures, parathion mixtures, tetraethyl dithio pyrophosphate mixtures, and tetraethyl pyrophosphate mixtures, dry.
73.379 Cyanogen bromide.
73.384 Chloroacetone, stabilized.
73.385 Tear gas grenades, tear gas candles, or similar devices.
73.386 Miscellaneous dangerous substances.
73.389 Packaging requirements for radioactive materials.

Subpart I — Emergency Response Forms

73.429 Emergency response form, carloads.

APPENDIX A— Copies of Emergency Response Forms.

APPENDIX B — Procedure for testing Chemical Compatibility and Rate of Permeation in Polyethylene Packaging and Receptacles.

PART 73 — REGULATIONS APPLYING TO SHIPPERS

§ 73.1 Offering dangerous goods. (a) No shipper may offer dangerous goods to a carrier for transportation by rail unless such goods are packaged, loaded and stayed according to the provisions of this part.

§ 73.7 Department of National Defence. (a) Shipments of dangerous commodities offered by or consigned to the Department of National Defence of the Dominion of Canada, must be packed, including limitations of weight, in accordance with these regulations or in containers of equal or greater strength and efficiency as required by their regulations.

§ 73.8 Import shipments of dangerous goods from the United States. (a) Dangerous goods which are packaged in accordance with the dangerous commodities regulations prescribed by the Department of Transportation of the United States for rail transportation in that country may be transported by railways subject to the jurisdiction of the Canadian Transport Commission from their point of entry to destinations within Canada or from their point of entry to destinations in the United States via a Canadian route as if packaged in accordance with these regulations.

(b) Except as specified in § 73.301(i)(1) containers complying in all respects with the applicable container specification of the Department of Transportation of the United States may be substituted for containers of the same specification number under part 78 of these regulations.

§ 73.9 Shipment of Dangerous Goods in Accordance with the International Maritime Dangerous Goods Code. (a) Subject to paragraph (b) railway companies under the jurisdiction of the CTC may carry dangerous goods, other than dangerous goods contained in portable tanks and other than compressed gases, if the goods are in full compliance with the IMDG Code, provided that the goods where packaged, are blocked and braced in accordance with directives issued from time to time by the Director of Operation, R.T.C.

(b) Compressed gases in cylinders approved by the C.T.C. and in aerosols in full compliance with the IMDG Code are acceptable for rail transportation under the conditions prescribed in paragraph (a).

(c) Full carloads, containerloads and trailerloads of dangerous goods shall be accompanied by an Emergency Response Form as prescribed by § 73.429.

§ 73.12 Life Saving Devices. (a) Life saving devices (life rafts and accessory equipment) which are approved by the Canadian Coast Guard are not subject to these regulations.

SUBPART A — PREPARATION OF COMMODITIES FOR TRANSPORTATION BY CARRIERS BY RAIL FREIGHT OR RAIL EXPRESS

§ 73.21 Forbidden materials and packages.

Unless otherwise provided in these regulations, the offering for transportation of the following is forbidden:

(a) A Dangerous Commodity in the same packaging, vehicle or container with another Dangerous Commodity, the mixing of which would be liable to cause a dangerous evolution of heat or gas, or produce corrosive materials, except as provided in §§ 73.152(a) and 73.242(a) and (b).

§ 73.22 Shipper's responsibility. (a) Where containers are supplied by the shipper, the shipper shall be responsible to determine that shipments of explosives and other dangerous goods are made in containers which, unless otherwise provided in this part (see § 73.9), have been made, assembled with all parts or fittings in their proper place, and marked in compliance with applicable specifications or with specifications of the Commission in effect at date of manufacture of container. The shipper may accept the manufacturer's certification or specification marking to determine that the containers were manufactured in accordance with applicable specifications. Where containers are supplied by the carrier, the shipper shall determine that the containers in which goods are to be loaded are proper containers for the transportation of such goods by examining the manufacturer's identification plate, specification marking, or certification by the carrier.

(b) Prior to each shipment of fissile radioactive materials, and Type B or large quantities of radioactive materials, the shipper shall notify the consignee of the dates of shipment and of expected arrival. The shipper shall also notify each consignee of any special loading/unloading instructions prior to his first shipment.

§ 73.23 Previously authorized packaging. (a) Where the regulations require Spec. 6D or 37M cylindrical steel overpacks, Spec. 5B, 6J, or 37A (single-trip container) metal drums manufactured before March 18, 1964, having inside Spec. 2S, 2SL, 2T, or 2TL polyethylene container, may be continued in use for the goods and gross weights for which they were previously authorized.

(b) Reusable molded polyethylene containers for use without overpack complying with Spec. 34, manufactured before September 5, 1966, may be continued in use, if they are plainly marked "ICC-34" or "BTC-34", and are embossed with the maker's name or symbol, rated capacity, and the month and year of manufacture.

§ 73.24 Standard requirements for all packages. (a) Each package used for shipping explosives or other dangerous goods under this chapter shall be so designed and constructed, and its contents so limited, that under conditions normally incident to transportation —

(1) There will be no significant release of the explosive or other dangerous goods to the environment;

(2) The effectiveness of the packaging will not be substantially reduced; and

(3) There will be no mixture of gases or vapours in the package which could, through any credible spontaneous increase of heat or pressure, or through an explosion, significantly reduce the effectiveness of the packaging.

(b) Dangerous goods for which detailed specifications for packaging are not set forth in this part must be securely packaged in strong, tight packages meeting the requirements of this section.

(c) Packaging used for the shipment of explosives or other dangerous goods under this chapter shall, unless otherwise specified or exempted therein, meet all of the following design and construction criteria:

(1) Each specification container will show markings in an unobstructed area with letters and numerals identifying that specification (e.g., CTC-105A200, CTC-6K). Required marking on newly manufactured containers shall be the letters CTC.

(i) The marking is a certification that the packaging complies with all specification requirements.

(ii) The name and address or the symbol of the manufacturer, or the user, who assumes responsibility for compliance with the specification requirements, shall be included. Symbol letters must be registered with the Commission. Duplicate symbols are not authorized.

(iii) The markings shall be stamped, embossed, burned, printed, or otherwise marked on the packaging to provide adequate accessibility, permanency, and contrast so as to be readily apparent and understood.

(iv) Unless otherwise specified, letters and numerals shall be at least 1/2 inch high.

(v) Packaging which does not comply with the applicable specification must not be marked to indicate such compliance.

(2) Steel used shall be low-carbon, commercial quality steel. Stainless, open hearth, electric, basic oxygen, or other similar quality steels are acceptable. Steel sheets of specified gauge shall comply with the following:

Gauge No.	Nominal thickness (inches)	Minimum thickness (inches)
12	0.1046	0.0946
13	0.0897	0.0817
14	0.0747	0.0677
15	0.0673	0.0603
16	0.0598	0.0533
17	0.0538	0.0478
18	0.0478	0.0428
19	0.0418	0.0378
20	0.0359	0.0324
22	0.0299	0.0269
23	0.0269	0.0239
24	0.0239	0.0209
26	0.0179	0.0159
28	0.0149	0.0129
30	0.0120	0.0110

(3) Lumber used shall be well seasoned, commercially dry, and free from decay, loose knots, knots that would interfere with nailing, and other defects that would materially lessen the strength.

(4) Welding and brazing shall be performed in a workmanlike manner using suitable and appropriate techniques, materials, and equipment.

(5) Packaging materials and contents shall be such that there will be no significant chemical or galvanic reaction among any of the materials in the package.

(6) Closures shall be adequate to prevent inadvertent leakage of the contents under normal conditions incident to transportation. Gasketed closures shall be fitted with gaskets of efficient material which will not be deteriorated by the contents of the container.

(7) Nails, staples, and other metalic devices shall not protrude into the interior of the outer packaging in such a manner as to be likely to cause failures.

(8) The nature and thickness of the packaging shall be such that friction during transport does not generate any heating likely to decrease the chemical stability of the contents.

(d) For specification containers, compliance with the applicable specifications shall be required in all details, except as otherwise provided in this chapter.

(e) Polyethylene packagings and receptacles.

(1) Polyethylene used in packagings must be of a type compatible with the lading and must not be permeable to the extent that a hazardous condition can occur during transportation, handling, emptying or refilling.

(2) Each polyethylene packaging or receptacle which is used for liquid dangerous goods must be capable of withstanding without failure the procedure specified in Appendix B of this Part ("Procedure for Testing Chemical Compatibility and Rate of Permeation in Polyethylene Packagings and Receptacles") and the maximum rate of permeation of dangerous lading through or into the polyethylene packaging or receptacle may not exceed the following rates:

(i) 0.5 percent for materials meeting the definition of a poison and 2.0 percent for other dangerous goods, when subjected to temperatures no lower than 18°C (64°F) for 180 days in accordance with Test Method 1; or

(ii) 0.5 percent for materials meeting the definition of a poison and 2.0 percent for other dangerous goods, when subjected to a temperature no lower than 50°C (122°F) for 28 days in accordance with Test Method 2; or

(iii) 0.5 percent for materials meeting the definition of a poison and 2.0 percent for other dangerous goods, when subjected to a temperature no lower than 60°C (140°F) for 14 days in accordance with Test Method 3.

(3) Alternative procedures or rates of permeation are permitted if they yield a level of safety equivalent to or greater than that provided under subparagraph (e)(2) of this section and are approved by the Director of Operations, R.T.C.

(f) All outside packagings must be tightly and securely closed. Inside packages must be cushioned as prescribed and in any case sufficiently to preclude leaking or breakage.

§ 73.28 Reuse of containers. (a) Containers used more than once (refilled and reshipped after having been previously emptied) must be in such condition, including closing devices and cushioning materials, that they will protect their contents during transit as efficiently as new containers. Repairs must be made in an efficient manner in accordance with requirements for materials and construction as prescribed in the container specification and parts that are weak, broken, or otherwise deteriorated must be replaced (see paragraphs (e), (f), (g), (h), and (i) of this section for containers that cannot be reused).

(1) Retest of carboy packages must have been made by or for shippers, or their authorized agents, as required by applicable provisions of the specifications in these regulations before carboys which are to be offered for transportation are filled.

NOTE 1: Tests not required by shipper who fills and ships or who reships filled carboys for one shipment only carboy packages which have been properly tested by another shipper or a duly authorized agency.

(b) Markings applied as prescribed by the specifications must be maintained in a legible condition.

(c) If, on account of painting or any other reason, the markings as prescribed for any container cannot be kept plain and legible, a metal plate, brazed or soldered, or otherwise securely fastened to the container, with a reproduction of the

prescribed markings plainly stamped theron, will be permitted.

(d) Containers previously used for the shipment of any explosive or other dangerous commodity must have the old markings, including name of contents, addresses, and labels, if any, thoroughly removed or obliterated before being used for the shipment of other articles.

(e) Boxes previously used for high explosives containing a liquid explosive ingredient not contained in an inside metal container must not again be used for shipments of any character.

(l) Boxes that have been contaminated by liquid explosive compositions must not again be used for shipments of any character.

(f) Kegs previously used for any chlorate must not again be used for shipments of any character.

(g) Metal kegs previously used for black powder not contained in an interior package must not be again used for shipment of any explosive.

NOTE 1: Until further order of the Commission, metal kegs, previously used for the shipment of black powder not contained in an interior package, may be used provided the kegs are in good physical condition and are not liable to permit escape of contents during transportation. Empty kegs previously used for shipment of black powder must be entirely free of black powder on the inside and outside before being offered for transportation.

(h) Except as provided in subsections (m) and (n), single-trip containers made under specifications prescribed from which contents have once been removed following use for shipment of any commodity, shall not be again used as shipping containers for any dangerous commodity.

(i) Containers which are designated as nonreusable containers, marked NRC, and made under specifications prescribed in these Regulations, from which contents have once been removed following use for shipment of any article, must not be again used as shipping containers for any dangerous commodity.

(j) Cylinders or other containers which are designated as nonrefillable or for single-trip use under the shipping container specifications, and from which contents have once been removed following use for the shipment of any article, must not be again used as shipping containers for compressed gases.

(k) Containers used for shipments of etching acid liquid, n.o.s. must not be reused for shipment of any commodity.

(l) Cylinders used in anhydrous hydrofluoric acid service must comply with the requirements of § 73.264(b)(1) and must not be used in any other service.

(m) Spec. 17C, 17E, and 17H steel drums from which contents have been removed, may be reused as prescribed in this part as packagings for shipment of flammable liquids, solid substances included in class 4, organic peroxides, oxidizing substances, poisons covered by § 73.370, radioactive materials, and corrosive liquids covered by § 73.249 and 73.249a, only if the following requirements, in addition to the other requirements of this section, are complied with prior to each reuse:

(1) Each drum must be thoroughly cleaned to remove all residues and foreign matter, inspected for deterioration or defects, and returned to its original shape and contour. All closure devices and parts must be removed (if removable), inspected for defects, and replaced as necessary. Each open head cover gasket must be replaced. Any drum which shows evidence of deterioration (e.g., visible pitting; creases; significant reduction in parent metal thickness from rust, corrosion, or cleaning processes; metal fatigue; or other material defects) or which cannot be returned to its original shape and contour does not qualify for reuse.

(2) The entire surface of each drum must be tested for leakage by constant internal air pressure. The leakage test must be conducted by submersion under water, by completely covering the surface with soap suds or oil, or by some other method that will be equally sensitive. The air pressure must be maintained for a period of time sufficient to permit a complete inspection for leaks. The minimum air pressure for the test must be as follows:

Specification No.	Capacity	Minimum test pressure p.s.i.
17C	All	15
17E	Over 10 gallons	7
	10 gallons or less	5
17H	Over 10 gallons	7
	10 gallons or less	5

If leaking, the drum does not qualify for reuse.

(3) Marking:

(i) All previous test markings, commodity identification markings, and labels must be removed.

(ii) The outside of each drum qualifying for reuse under this section must be marked on the body within 10 inches of the top head, in letters of a contrasting colour with the following information: "Tested," the month and year of the test, and the CTC registration number of the reconditioner.

For example:

TESTED 2/70
CTC R1001

The registration number required for this marking must be obtained from the Director of Operation, Railway Transport Committee, Canadian Transport Commission.

(iii) The outside of each removable head, for drums over 5 gallons capacity, must be marked to indicate the gauge of the steel used in making the head (e.g., "16-gauge").

(iv) Marking must conform to the requirements of § 73.24.

(n) Any drum meeting one specification which has been altered to meet another specification must be capable of meeting the new specification in all respects.

(1) Each drum so altered must be inspected and tested in accordance with paragraph (m) of this section.

(2) The specification marking on the drum must be as required by the new specification, and must be on a metal plate securely attached to the drum. The means of attachment of the metal plate must not adversely affect the integrity of the drum. The plate must be located on the body within 10 inches from the top head. The marking must conform to § 73.24. If the rated capacity is reduced by more than 2 per cent, the new rated capacity must be shown. Both the old and the new specification identification must be shown with the specification to which the drum is converted shown last, e.g., "17E/17H."

(o) Polyethylene packagings previously used for poisonous materials shall not be reused for any materials other than poisonous materials or dangerous goods.

§ 73.31 Qualification, maintenance, and use of tank cars. (a) General qualifications for use.

(1) Except as otherwise provided in paragraph (a)(2) of this section, every tank car used for the transportation of dangerous

commodities shall meet the requirements of the applicable specification and regulations for the transportation of the particular commodity. See paragraph (a)(3) of this section.

Where repairs, alterations or conversions to tank car tanks are performed requiring welding, riveting or removal of deformations, an AAR Exhibit R-1 report must be on file at the repair facility and open for scrutiny by an officer of the R.T.C.

(2) In addition to the tanks authorized in Part 73, tanks built prior to July 1, 1927, in compliance with the American Railway Association's Specifications for Tank Cars or tanks built in compliance with specifications of the Interstate Commerce Commission, if built or under construction on the effective dates thereof, are authorized for service as prescribed in the following table and notes, provided tanks and safety relief devices are retested as prescribed in paragraphs (c) and (d) of this section and equipped with approved valves, valve protection devices and safety relief devices.

Specifications prescribed in current regulations	Other specifications permitted (subject to the notes)	Notes
103	ARA-III, ARA-IV	2,3
103A	ARA-III	1,2
103B or 103B-W	ARA-III Rubber Lined	2
104	ARA-IV	2
105A200-W	105A100-W	5
105A200AL-W	105A100AL-W	5
105A300-W	ARA-V, ICC-105, 105A300	
105A400-W	105A400	
105A500-W	105A500	
105A600-W	105A600	
106A500-X	ICC-27 BE-27, 106A500	
106A800-X	106A800	
107A****	————	6

NOTE 1: ARA tanks must have been originally designed or subsequently reconstructed for the transportation of acids

NOTE 2: Tank cars equipped with safety vents must have the vent closure so chained or otherwise fastened as to prevent misplacement

NOTE 3: These cars must not be used for shipments of smokeless powder in water unless equipped with positive closure type bottom outlet valves.

NOTE 5: Tanks built as Spec. ICC-105A100-W or 105A100AL-W may be altered and reclassified as Spec. 105A200-W or 105A200AL-W, respectively, by installing safety relief valves, retesting and stencilling in accordance with the applicable specification.

NOTE 6: The test pressures of tanks built in the United States prior to January 1, 1956, may be increased to comply with current spec. ICC-107A except that tanks built prior to 1941 are not so authorized. Original and revised test pressure must be indicated and may be shown on a plate attached to the bulkhead of the car.

(3) Unless otherwise specifically provided in this part —

(i) When class 105A, 105AL, 106A, 109A-AL, 110A, 111A, 112A 112S, 112T, 112J, 114A, 114S, 114T, or 114J tank car tanks are prescribed, the same class tanks having higher marked test pressures than those prescribed may also be used.

(ii) When class 111AW1 tank car tanks are prescribed, class 111AW3 tank car tanks may also be used.

(iii) When class 112A tank car tanks are prescribed, classes 112S, 112T, and 112J tanks having equal or higher marked test pressures than those prescribed may also be used.

(iv) When class 112S tank car tanks are prescribed, classes 112T and 112J tanks having equal or higher marked test pressures than those prescribed may also be used.

(v) When class 114A tank car tanks are prescribed, classes 114S, 114T, and 114J tanks having equal or higher marked test pressures than those prescribed may also be used.

(vi) When class 114S tank car tanks are prescribed, classes 114T, and 114J tanks having equal or higher marked test pressures than those prescribed may also be used.

(vii) When a class 105A tank car is prescribed, class 105S and 105J tank cars having equal or higher marked test pressures than those prescribed may also be used.

(viii) When class 105S tank car tanks are prescribed, class 105J tank cars having equal or higher marked test pressures than those prescribed may also be used.

(4) Tank cars and appurtenances may be used for the transportation of any commodity for which they are authorized. Tank cars proposed for a commodity service other than authorized, must be approved for such service by the Association of American Railroads Committee on Tank Cars. Transfer of a tank car from one authorized service to another may be made only by the owner or owner's authorization. Classes 105A-W, 109A-W, 111A100-W-4, 112A-W, 114A-W tank cars may be used for any commodity for which they are approved by the Committee on Tank Cars and may be stencilled accordingly. When a tank car is stencilled to indicate that it is authorized for one commodity only, it must not be used for any other service.

NOTE 1: For additional requirements for tank cars for compressed gases, see § 73.314.

(b) Loading and shipping.

(1) Examination before shipping. When tanks are loaded and prior to shipping, the shipper must determine to the extent practicable, that the tank, safety appurtenances and fittings are in proper condition for the safe transportation of the lading. Tanks with bottom discharge outlets must have their outlet caps off, or outlet cap plugs open, during the entire time tanks are being loaded. After loading, tanks with bottom outlet valves which permit more than a dropping of the liquid with the outlet caps off, or the outlet cap plugs open, must not be offered for transportation until proper repairs have been made. Tanks which show any dropping or leaking of liquid contents at seams or rivets, must not be offered for transportation until proper repairs have been made.

(2) Loading requirements for tanks with interior heater coils. Tank cars equipped with interior heater coils, except when coils are rendered inoperative by blocking off the inlet and outlet, must be loaded with heater coil inlet and outlet caps off during entire time tanks are being loaded and show no leakage with caps off.

(3) Securing closures. All closures of openings in tank cars and of their protective housings must be properly secured in place by the use of a bar, wrench, or other suitable tool. A wrench having a handle at least 36 inches long must be used to apply the outlet valve cap. Manway covers and outlet valve caps must be made tight against leakage of vapour and liquid, by use of gaskets of suitable materials, before cars are tendered to carrier for transportation. Luting materials must not be used in outlet cap or on threads of bottom outlet.

(4) Inspection of safety relief devices on class 106A and 110A tanks. Safety relief devices of the frangible disc or fusible plug type used on tanks of classes 106A or 110A must be inspected before each loaded trip of tank by removing at least one vent for visual inspection; if it shows signs of deterioration, all devices must be removed and inspected and those which do not meet the requirements must be renewed.

(c) Periodic retest and reinspection of single-unit tank car tanks.

(1) Tanks, interior heater systems, and safety relief valves must be retested periodically as specified in Retest Table 1 of this paragraph. Retests may be made at any time during the calendar year the retest falls due except as provided in the notes.

Periodic retest of exterior heater systems is not a specification requirement.

(2) Each tank must be retested by completely filling the tank and manway nozzle or expansion dome with water or other liquid of similar viscosity except as otherwise provided for in Note (d) to Retest Table 1 and applying the specified pressure for 10 minutes if the tank is not insulated, or 20 minutes if the tank is insulated. There shall be no leakage or evidence of distress. The tank insulation and jacket need not be removed unless leakage is indicated by a drop in pressure. The liquid temperature must not exceed 100°F during the test. Caulking of welded joints to stop leaks developed during retests is prohibited.

(3) Unless longer retest interval is authorized, tanks in service 10 years or over must be internally inspected and interior heater systems inspected for defects which would make leakage or failure probable during transit.

(4) Anchor rivet housings, if used, must not be removed during retest. They shall be retested by applying an air pressure of 100 psi, through openings in the tank shell and must show no leakage.

(5) Interior heater systems must be retested hydrostatically at 200 psi. and must show no leakage.

(6) Safety relief valves must be retested with air or gas and must start to discharge at the pressure prescribed within plus or minus 3 per cent except that if the start-to-discharge pressure is under 100 psi., the valve must start to discharge at the pressure prescribed within plus or minus 3 psi. Valves must be vapour tight at the prescribed pressure.

(7) All tank cars built to one specification and authorized to be stencilled to another specification must be retested in accordance with the higher specification and the test pressure stencilled accordingly on the tank or jacket.

(8) Retests of tanks and safety relief devices must be reported by party making tests to car owner. Reports must show initials and numbers of cars, pressure to which tested, date and place of test, and by whom tested. Reports of latest retest must be retained by owner until the next retest has been accomplished and recorded.

(9) After repairs requiring welding, riveting, caulking of rivets, or hot or cold forming to restore tank contour, tanks must be retested as specified in Retest Table 1 of this paragraph before return to service. Glass, lead, or rubber-lined tanks must be retested before lining is renewed. Interior heater systems must be retested before return to service after repairs or renewals of any part of the system.

(10) The month and year of tests of tanks, safety relief valves, heater system and pressure to which tested must be stencilled on the tank or on jacket if insulated.

(11) Any glass, rubber, or lead-lined tank need not be periodically retested, but the interior heater systems and safety valves must be retested at the prescribed interval. See also subparagraph (9) of this paragraph.

(12) Any tank lined with an elastomeric polyvinyl chloride at least 3/32-inch thick or an elastomeric polyurethane at least 1/16-inch thick need not be periodically retested, but the heater system and safety relief valves must be retested at the prescribed intervals. The tank must be retested before lining is renewed.

RETEST TABLE 1

Specification	Retest interval — years [j]			Safety relief valve	Tank	Retest pressure — psi	
	Tank and interior heater systems					Safety relief valve	
	Up to 10 years	Over 10 to 22 years	Over 22 years			Start to discharge	Vapour tight
103	10	10	10	10	60	35[c]	28
103AL	.....	5	5	5	60	35[c]	28
103W	.....	20[p]	10	10	60	35[c]	28
103ALW	10	10	10	10	60	35	28
103A	5[d]	3	1	2	60	35	28
103AW[r]	5[d]	3	1	2	60	35	28
103A-ALW	5[d]	3	1	[e]	60	35[b]	28
103ANW	5[d]	3	1	2	60	35	28
103B	5[f]	3[f]	1[f]	None	60	.....	.....
103BW	5[f]	3[f]	1[f]	None	60	.....	.....
103C	5	3	1	[e]	60	35	28
103CAL	.....	2	1	[e]	60	35	28
103CW	5[d]	3	1	[e]	60	35[b]	28
103DW	5[d]	3	1	[e]	60	35	28
103EW	5[d]	3	1	[e]	60	35	28
104	10	10	10	10	60	35[c]	28
104A	10	10	10	5	100	75	.....
104W	.....	20[p]	10	10	60	35[c]	28
105	.....	.....	10[a]	5[a]	500	225[g]	180
105A100	10	10	10	5	100	75	60
105A100ALW	10	10	10	5	100	75	60
105A100W	10	10	10	5	100	75	60
105A200ALW	10	10	10	5	200	150	120
105A200F	10	10	10	5	200	150	120
105A200W	10	10	10	5	200	150	120
105A300	10[a]	10[a]	10[a]	5[a]	300	225[g]	180
105A300ALW	10	10	10	5	300	225	180
105A300W	10[c,f,i,t]	10[a,f,i,t]	10[a,f,i,t]	5[a,i,k]	300	225[g,n]	180[n]
105A400	10[a]	10[a]	10[a]	5[a]	400	300	240
105A400W	10[a]	10[a]	10[a]	5[a]	400	300[m]	240
105A500	10[a]	10[a]	10[a]	5[a]	500	375[h]	300
105A500W	10[a,f]	10[a,f]	10[a,f]	5[a,k]	500	375[h]	300
105A600	10[a]	10[a]	10[a]	5[a]	600	450	360
105A600W	10[a]	10[a]	10[a]	5[a]	600	450[m]	360
109A100ALW	10	10	10	5	100	75	60
109A200ALW	10	10	10	5	200	150	120
109A300ALW	10	10	10	5	300	225	180
109A300W	10	10	10	5	300	225	180
111A60ALW1	10	10	10	10	60	35	28
111A60ALW2	5[d]	3	1	[e]	60	35	28
111A60F1	10	10	10	10	60	35	28
111A60W1	.....	20[p]	10	10	60	35	28
111A60W2[q]	5	3	1	2	60	35	28
111A60W5	5	3	1	None	60	.....	.....
111A60W7	5	3	1	[e]	60	35	28
111A100ALW1	10	10	10	10	100	75	60
111A100ALW2	5	3	1	[e]	100	75	60
111A100F1	.....	10	10	10	100	75	60
111A100W1	.....	20[p]	10	10	100	75	60
111A100F2[q]	5	3	1	2	100	75	60
111A100W2[q]	5	3	1	2	100	75	60
111A100W3	.....	20[p]	10	10	100	75	60
111A100W4	10	10	10	5	100	75	60
111A100W5	5[f]	3[f]	1[f]	None	100	.....	.....
111A100W6	5[d]	3	1	[e]	100	75	60
112A200W	10	10	10	5	200	150	120
112A340W	10	10	10	5	340	255[n]	204[n]
112A400F	.....	10	10	5	400	300	240
112A400W	10	10	10	5	400	300[n]	240[n]
112A500W	10	10	10	5	500	375[h]	300
113A60W	[s]	[s]	[s]	5	[s]	30	24
113A175W	[s]	[s]	[s]	5	[s]	115	95
114A340W	10	10	10	5	340	255[n]	204[n]
114A400W	10	10	10	5	400	300[n]	240[n]
115A60ALW	10	10	10	5	60	35	28
115A60W1	10	10	10	5	60	35	28
115A60W6	10	10	10	5	60	35	28
EMERG, USG-A, B, and C	.....	10	10	10	60	25	.....
ARA-III	.....	.....	10	10	60	25[c]	20
ARA-III acid (unlined)	.....	.....	1	None	60	.....	.....
ARA-III (rubber lined)	.....	.....	[f]	None	60	.....	.....
ARA-IV	.....	.....	10	10	60	25[c]	20
ARA-IV-A	.....	.....	10	5	100	35	28
ARA-V	.....	.....	10[a]	5[a]	300	225[g]	180

[a] Tanks and safety relief valves in chlorine service must be retested every two years at any time during the calendar month the retest falls due. See § 73.314(c) Note 12.

[b] Specifications 103CW and 103A-ALW cars built prior to Aug. 31, 1956, equipped with safety relief valves set to discharge at 45 p.s.i., may be continued in service. Such valves may be set to discharge at 35 p.s.i. by installing a spring suitable for the lower pressure. Specifications 103A-ALW and 103CW tank cars used to transport anhydrous hydrazine or hydrazine solutions may have a safety relief valve having a start to discharge pressure of 45 p.s.i. with a tolerance of plus or minus 3 p.s.i. and a vapour tight pressure of 36 p.s.i.

[c] See paragraph (a) (2) Note 4 of this section.

[d] A commodity for which a tank is approved may be used for filling tank and dome when retesting tanks in service not over 10 years.

[e] Safety relief valve retest period is same as tank retest period.

[f] Nickel clad tanks in bromine service and any glass, rubber, or lead lined tank need not be periodically retested, but the interior heater systems and safety relief valves must be retested at the prescribed interval. See also paragraph (c) (9) of this section.

[g] If safety relief valves are used in combination with breaking pins designed to break at 225 psi., the safety relief valves must be retested and must start to discharge at 213 psi. plus or minus 3 per cent.

[h] If safety relief valves are used in combination with breaking pins designed to break at 375 psi., the safety relief valves must be retested and must start to discharge at 360 psi. plus or minus 3 per cent.

[i] Tanks and safety relief devices in hydrocyanic acid service must be retested and inspected by a written procedure filed with and approved by the Commission.

[j] When the retest interval requirement changes due to the age of the tank, the new retest interval specified is effective from the last retest date.

[k] Safety relief valves in bromine service must be retested every two years.

[l] Tanks complying with this specification need not be periodically retested, but safety relief devices must be retested every five years.

[m] When a safety relief valve is used in combination with a breaking pin device, the breaking pin device shall be designed to fail at a pressure of 75 per cent of the tank test pressure and safety relief valve shall be set for a start-to-discharge pressure of 71 per cent of the tank test pressure.

[n] If the alternate safety relief valve start-to-discharge pressure setting is used, the retest pressures of the safety relief valves must be in accordance with the provisions of § 79.102-11.

[p] Retest period for interior heater systems on cars so equipped is 10 years.

[q] When tanks are converted to class 111AW2 or F2 from existing pressure type tanks, the retest interval must be computed from the date converted instead of the date built. The conversion date must be stencilled on the tank below the built date.

[r] When tanks are converted to class 103AW from existing 103W or 103BW tanks, the retest interval at conversion must be computed the same as 10-year-old equipment.

[s] Tanks complying with this specification need not be periodically retested.

[t] Tanks in sodium metal service may be visually inspected at least once every 10 years instead of being retested hydrostatically. Date of the visual inspection must be stencilled on the tank near the other required markings.

(d) Periodic retest and reinspection of tanks other than single-unit tank car, tanks.

(1) Tanks designed to be removed from cars for filling and emptying and tanks to spec. 107A**** and their safety relief devices must be retested periodically as specified in Retest Table 2 of this paragraph. Retests may be made at any time during the calendar year the retest falls due.

(2) Each tank, except as provided in subparagraph (9) of this section, must be subjected to the specified hydrostatic pressure and its permanent expansion determined by an accurate method. Pressure must be maintained for 30 seconds and as much longer as may be necessary to secure complete expansion of the tank. Pressure gauge must permit reading to an accuracy of one per cent. Expansion gauge must permit reading of total expansion to an accuracy of one per cent. Expansion must be recorded in cubic centimeters. Permanent volumetric expansion must not exceed 10 per cent of total volumetric expansion at test pressure and tank must not leak or show evidence of distress.

(3) Each tank, except tanks to spec. 107A, must also be subjected to interior air pressure test of at least 100 psi under conditions favorable to detection of any leakage. No leaks shall appear.

(4) Safety relief valves must be retested by air or gas, must start to discharge at or below the prescribed pressure and must be vapour tight at or above the prescribed pressure.

(5) Frangible discs or fusible plugs must be removed from the tank and visually inspected.

(6) Tanks must be retested as specified in Retest Table 2 of this paragraph before return to service after repairs involving welding or heat treatment.

(7) The month and year of test, followed by a "V" if visually inspected as described in subparagraph (d)(9) of this section, must be plainly and permanently stamped into the metal of one head or chime of each tank passing test; for example, 1-60 for January 1960. On 107A**** tanks, the date must be stamped into the metal of the marked end: except that if all tanks mounted on a car have been tested, the date may be stamped into the metal of a plate permanently applied to the bulkhead on the "A" end of the car. Date of previous tests and all prescribed markings must be kept legible.

(8) Retests of tanks and safety relief devices must be reported by party making tests to owner of tank. Reports must show registered identifying marks and serial number pressure to which tested, date and place of test, and by whom tested. Reports of latest retest must be retained by owner until the next retest has been accomplished and recorded.

(9) Tanks of 106A and 110-A-W specifications used exclusively for transporting fluorinated hydrocarbons and mixtures thereof which are free from corroding components may be given a periodic complete internal and external visual inspection in lieu of the periodic hydrostatic retest. Visual inspections shall be made only by competent persons. Acceptance or rejection of tanks shall be based upon the methods used for cylinders in Compressed Gas Association's Pamphlet C-6, and the results shall be recorded on a suitable data sheet, the completed copies of which shall be kept by the owner as a permanent record. The points to be recorded and checked on these data sheets are: Date of inspection (month and year followed by a "V" to indicate visual inspection); BTC, RTC or CTC specification number; tank identification (registered symbol and serial number, date of manufacture and ownership symbol); type of protective coating (painted, etc., and statement as to need of refinishing or recoating); conditions checked (leakage, corrosion, gouges, dents or digs, broken or damaged chime or protective ring, fire, fire damage, internal condition); disposition of tank (returned to service, returned to manufacturer for repair or scrapped).

RETEST TABLE 2

Specification	Retest interval — years		Retest pressure — psi		Safety relief pressure — psi	
	Tank	Safety relief devices[e]	Tank hydrostatic expansion[d]	Tank air test	Start to discharge	Vapour tight
ICC-27	5	2	500	100	375	300
106A500	5	2	500	100	375	300
106A500X	5	2	500	100	375	300
106A800	5	2	800	100	600	480
106A800X	5	2	800	100	600	480
106A800NCI	5	2	800	100	600	480
107A****	5[c]	2[a]	800[b]	None	None	None
110A500-W	5	2	500	100	375	300
110A800-W	5	2	800	100	600	480
110A1000W	5	2	1000	100	750	600
BE-27	5	2	500	100	375	300

[a] If 107A**** tanks are used for transportation of flammable gases, one frangible disc from each car must be burst at the interval prescribed. The sample disc must burst at a pressure not exceeding the marked test pressure of the tank and not less than 7/10 of the marked test pressure. If the sample disc does not burst within the prescribed limits, all discs on the car must be replaced.

[b] The hydrostatic expansion test pressure must at least equal the marked test pressure.

[d] See § 73.31 (d) (9).

[c] Safety relief valves of the spring-loaded type on tanks used exclusively for fluorinated hydrocarbons and mixtures thereof which are free from corroding components may be retested every 5 years.

(e) Tank car tanks subjected to the action of fire.

(1) Tank car tanks of other than classes 106A, 107A or 110A bearing evidence of damage to the metal by fire must be withdrawn from transportation service except that if the damage to the tank is local only or confined to not more than 25 per cent of the tank surface, the damaged material may be replaced. See paragraph (f) (1) of this section for procedure for handling tank car tanks with more than 25 per cent of the tank surface damaged.

(2) Tank car tanks of classes 106A, 107A, or 110A bearing evidence of damage to the metal by fire must be withdrawn from transportation service until they have been inspected inside and outside to determine that no reduction in wall thickness has resulted, and have been heat-treated and retested. These operations must be carried out, supervised and reported as prescribed by the specifications for original heat treatment and test.

(f) Repairs or alterations.

(1) For procedure to be followed in making repairs or alterations to all tank car tanks and securing approval therefor, see Appendix R, Association of American Railroads Specifications for Tank Cars.

(2) After alterations of tank cars or equipment therefor from original design, a certificate of compliance with the respective specification must be furnished to the car owner, to the Commission, the Bureau of Explosives, and to the Secretary, Mechanical Division, Association of American Railroads.

§ 73.32 Qualification, testing, maintenance, and use of portable tanks. (a) Except as otherwise provided in this section, every portable tank container used for the transportation of dangerous commodities shall fulfill the requirements of the specification and regulations for the transportation of the particular commodity. A manufacturer's data report of the portable tank container shall be procured and retained in the files of the owner during the time that such portable tank container is used for such service.

(d) Continued use of an existing portable tank constructed to specification 52 or 53 is authorized only for a tank constructed before October 1, 1974.

(e) Each portable tank used for the transportation of a dangerous commodity must be successfully retested before further use in accordance with the following:

(1) Each tank must be retested as prescribed in subparagraph (2) of this paragraph, in accordance with the following schedule:

(i) Spec. 51: at least once every 5 years.

(ii) Spec. 52, 53, 56, and 57: at least once every 2 years.

(iii) Spec. 60: at the end of the first 4-year period after the original test; at least once every 2 years thereafter up to a total of 12 years of service; and at least once annually thereafter. Retesting is not required on a rubber-lined tank except before each relining.

(iv) Any other portable tank authorized by this part for transportation of compressed gases (including liquefied compressed gases): at least once every 5 years.

(2) Unless otherwise specified, each tank must be retested in accordance with the following test procedures:

(i) Each Spec. 60 tank must be retested in accordance with its required pressure test. A Spec. 57 tank must be retested in accordance with its required pressure test. Any other tank must be tested by a minimum pressure (air or hydrostatic) of at least 2 pounds per square inch gauge or at least one and one-half times the design pressure (maximum allowable working pressure, or re-rated pressure) of the tank, whichever is greater. During each air pressure test, the entire surface of all joints under pressure must be coated with or immersed in a solution of soap and water, heavy oil, or other material suitable for the purpose of detecting leaks. The pressure must be held for a period of time sufficiently long to assure detection of leaks. During the air or hydrostatic test, relief devices may be removed, but all the closure fittings must be in place and the relief device openings plugged. Lagging need not be removed from a lagged tank if it is possible to maintain the required test pressure at constant temperature with the tank disconnected from the source of pressure.

(ii) While under the test pressure, the tank must be visually

inspected for leakage, defective fittings and welds, defective closures, significant dents, and other defects or abnormalities which indicate a potential or actual weakness that could render the tank unsafe for the transportation of a dangerous commodity.

(iii) A tank fails to meet the requirements of the pressure test if, during the test, there is a permanent distortion of the tank exceeding that permitted by the applicable specification, if there is any leakage, or if any deficiencies described in subdivision (ii) of this subparagraph are found. Any tank that fails must be rejected and may not be used again for the transportation of a dangerous commodity unless the tank is adequately repaired and thereafter a successful test is conducted in accordance with the requirements of this paragraph.

(3) The date of the most recent periodic retest must be marked on the tank, on or near the metal certification plate. Marking must be in accordance with §73.24.

(4) The owner of the tank or his authorized agent must retain a written record indicating the date and results of all required tests and the name and address of the tester, until the next retest has been satisfactorily completed and recorded.

(f) Each portable tank authorized by this Part including each special permit tank (other than a tank covered by paragraph (e) (1) (iv) of this section) which is not in compliance with one of the specifications listed in paragraph (e) of this section, must be tested in accordance with the procedures prescribed in paragraph (e) of this section for the type of portable tank most nearly equivalent in design and usage. A tank constructed in accordance with paragraph U-68 or U-69 of previous editions of the ASME Code, and which has not been re-rated must be hydrostatically retested at twice the design pressure instead of the one and one-half times prescribed in paragraph (e) (2) (i) of this section.

(g) Without regard to any other retest requirements, any tank that shows evidence at any time of bad dents, corroded areas, leakage, or other conditions that indicate weakness which could render the tank unsafe for the transportation of a dangerous commodity, must be retested as prescribed in paragraph (e) (2) of this section.

(h) Any tank that has been in an accident and that has been damaged to an extent that may adversely affect its product retention capability, must be retested as prescribed in paragraph (e) (2) of this section.

(i) Any tank that has not been used to transport a dangerous commodity for a period of 1 year or more may not be returned to dangerous commodity service until it has been tested successfully in accordance with the requirements of paragraph (e) (2) of this section.

(j) The Commission may require the testing under prescribed conditions of any tank when probable cause appears for suspecting that such tank is in unsafe operating condition.

(k) The repair of tanks is authorized, provided such repairs are made under requirements prescribed in the "Code" for the original design and construction.

(l) In addition to any other provisions of the specification, no tank shall be repaired, or remodeled, as to cause leakage or cracks or likelihood of leakage or cracks, by areas of stress concentration due to shrinkage of cooling metal in welding operations, sharp fillets, reversal of stresses, or otherwise.

(2) No field welding shall be done except to non-pressure parts.

(i) The bursting strength of any piping and fittings shall be not less than four times the design pressure of the tank, and not less than four times that pressure to which, in any instance, it may be subjected in service, by the action of a pump or other device (not including safety relief valves) the action of which may be to subject certain portions of the tank piping to pressures greater than the design pressure of the tank.

(1) Welded pipe joints shall be used wherever possible. Joints in copper tubing where permitted shall be of the brazed type or of any equally strong metal union type. Melting point of brazing material must be not less than 1,000°F. Such joints shall in any event be of such a character as not to decrease the strength of the tubing, as by the cutting of threads.

(2) Fittings shall be extra heavy. Non-malleable metals shall not be employed in the construction of valves or fittings.

(3) Suitable provision shall be made in every case to allow for expansion, contraction, jarring and vibration of all pipe. Slip joints shall not be used for this purpose.

(4) Piping and fittings shall be grouped in the smallest practicable space and shall be protected from damage as required by the specification.

(5) All piping, valves and fittings on every tank shall be leakage tested with gas or air after installation and proved tight at not less than the design pressure of the tank on which they are used. In the event of replacement, all such piping, valves, or fittings so replaced shall be tested in accordance with the requirements of this section before the tank is returned to transportation service. The requirements of this section shall apply with equal force to all hose used on such tanks, except that such hose may be so tested either before or after installation on the tank.

(m) All materials of construction used in portable tank containers and their appurtenances shall not be subject to destructive attack by the contents of the tank.

(1) All parts of tanks and appurtenances for anhydrous ammonia shall be steel. No copper, silver, zinc, nor their alloys shall be permitted. Brazed joints shall not be permitted.

(n) Each outlet of portable tanks used for the transportation of liquefied compressed gases, except carbon dioxide, shall be provided with a suitable automatic excess-flow valve. These valves shall be located inside the tank or at a point outside the tank where the line enters or leaves the tank. The valve seat shall be located inside the tank or shall be located within a welded flange or its companion flange, or within a nozzle, or within a coupling. The installation shall be made in such a manner as reasonably to assure than any undue strain which causes failure requiring functioning of the valve shall cause failure in such a manner that it will not impair the operation of the valve.

Exception. Safety device connections and liquid level gauging devices which are so constructed that the outward flow of tank contents shall not exceed that passed by a No. 54 drill size opening are not required to be equipped with excess-flow valves.

(1) Excess-flow valves shall close automatically at the rated flows of gas or liquid as specified by the valve manufacturer. The connections or lines on each side of the excess-flow valve, including valves, fittings, etc., shall have a greater capacity than the rated flow of the excess-flow valve.

(2) Excess-flow valves may be designed with a by-pass, not to exceed a No. 60 drill size opening, to allow equalization of pres-

sures.

(3) Filling and discharge lines shall be provided with manually operated shut-off valves located as close to the tank as is practicable. The use of so-called "Stop-Check" valves to satisfy with one valve the requirements of this subparagraph and of paragraph (n) of this section, is forbidden.

(o) Each tank for carbon dioxide and nitrous oxide shall be lagged with a suitable insulation material of such thickness that the overall thermal conductance is not more than 0.08 Btu per square foot per degree F. differential in temperature per hour. The conductance shall be determined at 60°F. Insulation material used on tanks, for nitrous oxide shall be noncombustible.

(p) A refrigerating and/or heating coil or coils may be installed in tanks for carbon dioxide and nitrous oxide. Such coils must be tested externally to at least the same pressure as the test pressure of the tank. The coils must also be tested internally to at least twice the working pressure of the heating or refrigerating system to be used but in no case less than the test pressure of the tank. Such coils shall be securely anchored. The refrigerant or heating medium to be circulated through the coil or coils must be such as to cause no adverse chemical reaction with the tank or tank contents in case of leakage.

§ 73.34 Qualification, maintenance and use of cylinders.[1]

(a) General qualification for use of cylinders. (See §§ 73.1 through 73.30 for requirements applying to all shipments.)

(1) No person may charge or fill a cylinder unless it is as specified in this part. A cylinder that leaks, is bulged, has defective valves or safety devices, bears evidence of physical abuse, fire or heat damage, or detrimental rusting or corrosion must not be used unless it is properly repaired and requalified as prescribed in these regulations.

(2) When cylinders with a marked pressure limit are prescribed other cylinders made under the same specification but with a higher marked service pressure limit are authorized. For example, cylinderss marked CTC 4B500 may be used where CTC-4B300 is specified.

(b) Grandfather Clause. A cylinder in domestic use previous to the date upon which the specification therefor was first made effective in these regulations may be used if the cylinder has been properly tested and otherwise complies with the requirements applicable for the gas with which it is charged.

(c) Cylinder marking. Each required marking on a cylinder must be maintained so that it is legible. Retest markings and original markings which are becoming illegible may be reproduced by stamping on a metal plate which must be permanently secured to the cylinder.

(1) Additional markings not affecting any of the prescribed markings may be made in accordance with marking requirements of the specification.

(2) When the space originally provided for dates of subsequent retests becomes filled, the stamping of additional test dates into the external surface of the footring of a cylinder is authorized.

(3) A cylinder marking may not be changed except as follows:

(i) Marked service pressure may be changed only upon application to the Director of Operation, R.T.C. and receipt of written instruction as to the procedure to be followed. Such a change is not authorized for a cylinder which has failed to pass the prescribed periodic hydrostatic retest unless it is reheat treated and requalified in accordance with the requirements of this section.

(ii) Changes may be made in serial numbers and in the identification symbols by the owners. Identification symbols must be registered and approved by the Director of Operation, R.T.C. Serial numbers and identification symbols may be changed only by the owner upon his receipt of written approval from the Director of Operations, R.T.C. The request for approval must identify the existing markings (including serial numbers) that correspond with the proposed new markings.

(4) (Cancelled).

(5) (Cancelled).

(d) Safety relief devices. Each cylinder charged with compressed gas, unless excepted in this paragraph, shall be equipped with one or more pressure relief devices selected as to size, type, location, and quantity and tested in accordance with CGA Pamphlets S-1.1. The pressure relief device system must be capable of preventing rupture of the normally charged cylinder when subjected to a fire test conducted in accordance with CGA Pamphlet C-14, or in the case of an acetylene cylinder, CGA Pamphlet C-12. (Cylinders shall not be shipped with leaking safety relief devices. Safety relief devices must be tested for leaks before the charged cylinder is shipped from the cylinder filling plant; it is expressly forbidden to repair leaking fuse plug devices, where leak is through the fusible metal or between the fusible metal and the opening in the plug body, except by removal of the device and replacement of the fusible metal.) Exceptions are as follows:

(1) Except as provided in Notes 1, 2 and 3, safety relief devices are not required on cylinders 12 inches or less in length, exclusive of neck, and 4½ inches or less in outside diameter.

NOTE 1: Safety relief devices are required on specifications 9, 40, 41, and 39 cylinders. Metal safety relief valves are required on specification 39 cylinders used for liquefied flammable gases. Fusible safety relief devices are not authorized on specification 39 cylinder containing liquefied compressed gases.

NOTE 2: Safety relief devices are required on cylinder charged with a liquefied gas for which this part requires a service pressure of 1,800 psi. or higher.

NOTE 3: Safety relief devices are required on cylinders charged with non-liquefied gases to a pressure of 1,800 psi. or higher at 70°F.

(2) Except for specification 39 cylinders and cylinders for acetylene in solution, safety relief devices are not required on cylinders charged with non-liquefied gas under pressure of 300 psi. or less at 70°F.

(3) Safety relief devices are prohibited on cylinders charged with gas or liquid commodities requiring a placard with a square background.

(4) Safety relief devices are prohibited on cylinders charged with fluorine.

(5) Safety relief devices are not required on cylinders charged with methyl mercaptan; with mono, di, or trimethylamine, anhydrous; with not over 10 pounds of nitrosyl chloride; or with less than 165 pounds of anhydrous ammonia.

(6) (Cancelled).

(7) Safety relief devices, if used, must be in the vapour space of cylinders containing pyroforic liquids, n.o.s., covered by § 73.134.

(e) Each cylinder becomes due for periodic retest in accordance with the following table and exceptions thereto:

(1) This periodic retest must include a visual internal and external examination together with a test by interior hydrostatic

[1] Requirements covering cylinders are also applicable to spherical pressure vessels.

pressure in a water jacket or other apparatus of suitable form for the determination of the expansion of the cylinder. The test apparatus must be approved as to type and operation by the Commission. The internal inspection may be omitted for cylinders of the type and in the service described under paragraphs (e) (9) and (e) (10) of this section.

(2) Cylinders of CTC-4 series, without regard to date of previous test, that show bad dents or other evidence of rough usage, or that are corroded locally to such extent as to indicate possible weakness, or that have lost as much as 5 percent of their official tare weight, must be retested before being again charged and shipped. After any retest, the actual tare weight for those cylinders passing the test may be recorded as their new official tare weight.

Specification under which cylinder was made-	Minimum retest pressure (p.s.i.)	Retest periodic (years)
ICC-3	3000 psi	5
CTC-3A, 3AA,3AL	5/3 times service pressure, except non-corrosive service (see §73.34(e)(10))	5 or 10 (see §73.34(e)(11), (e)(14), and (e)(15).
CTC-3AX, 3AAX	5/3 times service pressure	5
CTC-3B, 3BN	2 times service pressure (see §73.34(e)(10))	5 or 10 (see §73.34(e)(14).
CTC-3C	Retest not required	
CTC-3D	5/3 times service pressure	5
CTC-3E	Retest not required	
CTC-3HT	5/3 times service pressure	3 (see §73.34(e)(13)).
CTC-4	700 psi	10
CTC-4A	5/3 times service pressure (see §73.34(e)(10))	5 or 10 (see §73.34(e)(14)).
CTC-4AA 480	2 times service pressure (see §73.34(e)(10))	5 or 10 (see §73.34(e)(11)).
CTC-4B, 4BA, 4BW 4B-240ET	2 times service pressure, except non-corrosive service (see §73.34(e)(10))	5 or 10 (see §73.34(e)(9) and (e)(14)).
CTC-4C	Retest not required	
CTC-4D, 4DA, 4DS	2 times service pressure	5
CTC-4E	2 times service pressure, (except non-corrosive service (see §73.34(e)(10))	5
CTC-4L	Retest not required	
CTC-8, 8AL	Retest not required	
CTC-9	400 psi (maximum 600 psi)	5
ICC-25	500 psi	5
ICC-26 for filling at over 450 psi	5/3 times service pressure	5
ICC-26 for filling at 450 psi and below	2 times service pressure, except non-corrosive service (see §73.34(e)(10))	5 or 10 (see §73.34(e)(9)).
ICC-33	800 psi	5
ICC-38	500 psi	5
Any cylinder with marked test pressure.	Retest at marked test pressure	5
Foreign cylinder charged for export	As marked on the cylinder, but not less than 5/3 of any service or working pressure marking	See §73.301(j).

NOTE 1: For cylinders not marked with a service pressure, see §73.301(e)(1).

(3) In hydrostatic retesting of a cylinder the pressure must be maintained for at least 30 seconds and as much longer as may be necessary to secure complete expansion of the cylinder. The gauge indicating the total expansion of the cylinder must be such that the total expansion can be read with an accuracy of 1 per cent, except that a reading to 0.1 cubic centimeter shall be acceptable. The gauge indicating the pressure must be capable of being read to within 1 percent of the test pressure. Any internal pressure applied previous to the test pressure shall not exceed 90 per cent of the test pressure. If, due to failure of the test apparatus, the test pressure cannot be maintained, the test may be repeated at a pressure, increased by 10 per cent or 100 psi, whichever is the lower value.

(4) A cylinder must be condemned when it leaks, or when internal or external corrosion, denting, bulging, or evidence of rough usage exists to the extent that the cylinder is likely to be weakened appreciably, or when the permanent expansion exceeds 10 per cent of the total expansion, except that for CTC-4E aluminum cylinders, when the permanent expansion exceeds 12 per cent of the total expansion. Except for CTC-3AL and CTC-4E aluminum cylinders, a cylinder condemned for excessive permanent expansion may be reheat-treated. (See paragraph (g) of this section.) CTC-4 series cylinders, condemned for other than excessive permanent expansion, may be repaired and rebuilt as otherwise provided in this section.

(5) Records showing the result of reinspection and retest must be kept by the owner or his authorized agent until either expiration of the retest period, or until the cylinder is again reinspected or retested, whichever occurs first.

(6) Each cylinder passing reinspection and retest must be marked with the date (month and year), plainly and permanently stamped into the metal of the cylinder or on a metal plate which must be permanently secured to the cylinder. For example, "4-70" for April 1970. The dash between the month and year figures may be replaced by the mark of the testing or inspecting agency. Stamping must be in accordance with marking requirements of the specification. Date of the previous tests must not be obliterated.

(7) Cylinders in chlorine or sulphur dioxide service made before April 20, 1915, must be retested at 500 psi.

(8) For cylinders of not over ten pounds water capacity which are authorized for service pressures not over 300 psi, the hydrostatic testing portion of the retest procedure may consist of application of the prescribed internal hydrostatic test pressure without the use of special apparatus and without the determination of total and permanent expansions. In this test the cylinders shall be examined while under pressure and must show no leak or other harmful defect as enumerated in paragraph (e)(4) of this section.

(9) Cylinders made in compliance with specifications CTC-4B, CTC-4BA, CTC-4BW, and ICC-26-300[1] which are used excusively for anhydrous dimethylamine, anhydrous monomethylamine; anhydrous trimethylamine; methyl chloride; liquefied petroleum gas, methylacetylene-propadiene, stabilized; or dichlorodifluoromethane, difluoroethane, difluoromonochloroethane, monochlorodifluoromethane, monochlorotetrafluoroethane, monochlorotrifluorethylene, or mixture thereof, or mixtures of one or more with trichloromonofluoromethane; and which are commercially free from corroding components and protected externally by suitable corrosion resisting coatings (such as galvanizing, painting, etc.) may be retested decenially (see Note 2) instead of quinquennially, or, as an alternative such cylinders may be subjected to an

[1] Use of existing cylinders authorized, but new construction not authorized.

internal hydrostatic pressure equal to at least two times the marked service pressure without determination of expansions (see Note 1), but this latter type of test must be repeated quinquennially after expiration of the first 10-year period (see Note 2). When subjected to this latter test, cylinders must be carefully examined under the test pressure and removed from service if leaks or other harmful defects exist. All tests must be supplemented by a very careful examination of the cylinder at each filling, and cylinders must be rejected if evidence is found of bad dents, corroded areas, a leak, or other conditions that indicate possible weakness which would render the cylinder unfit for service.

NOTE 1: Cylinders tested by the modified hydrostatic method shall be marked after each retest with the date of test as otherwise required but followed by the symbol S; for example 8-57S indicating retest by the modified method in August, 1957.

NOTE 2: Until futher order of the Commission the decennial retest period may be extended to a 12-year period, and the quinquennial retest period may be extended to a 7-year period after expiration of the first 12-year period.

(10) Cylinders made in compliance with the specifications listed in the table below and used exclusively in the service indicated may, in lieu of the periodic hydrostatic retest, be given a complete external visual inspection at the time such periodic retest becomes due. External visual inspection as described in CGA Pamphlet C-6 will, in addition to the following requirements prescribed herein, meet the requirements for visual inspection.

Cylinders made in compliance with —	Used exclusively for —
CTC-4,CTC-3A, CTC-3AA, CTC-3A480X, CTC-4A, CTC-4AA480 ...	Anhydrous ammonia of at lest 99.95% purity.
CTC-3A, CTC-3AA, CTC-3A480X, CTC-3B, CTC-4B, CTC-4BA, CTC-4BW, ICC-26-240,[1] ICC-26-300[1]	Butadiene, inhibited, which is commercially free from corroding components.
CTC-3A, CTC-3A480X, CTC-3AA, CTC-3B, CTC-4A, CTC-4AA480, CTC-4B, CTC-4BA, CTC-4BW	Cyclopropane which is commercially free from corroding components.
CTC-3A, CTC-3AA, CTC-3A480X, CTC-4B, CTC-4BA, CTC-4BW, CTC-4E	Fluorinated hydrocarbons and mixtures thereof which are commercially free from corroding components.
CTC-3A, CTC-3AA, CTC-3A480X, CTC-3B, CTC-4B, CTC-4BA, CTC-4BW, CTC-4E, ICC-26-240,[1] ICC-26-300[1]	Liquefied hydrocarbon gas which is commercially free from corroding components.
CTC-3A, CTC-3AA, CTC-3A480X, CTC-3B, CTC-4B, CTC-4BA, CTC-4BW, CTC-4E, ICC-26-240,[1] ICC-26-300[1]	Liquefied petroleum gas which is commercially free from corroding components.
CTC-3A, CTC-3AA, CTC-3B, CTC-4B, CTC-4BA, CTC-4BW, CTC-4E ...	Methylacetylene-propadiene, stabilized, which is commercially free from corroding components.
CTC-3A, CTC-3AA, CTC-3B, CTC-4B, CTC-4BA, CTC-4BW	Anhydrous mono, di, trimethylamines which are commercially free from corroding components.

[1] Use of existing cylinders authorized, but new construction not authorized

When this inspection is used in lieu of hydrostatic retesting, subsequent inspections are required 5 years after the first such inspection and periodically at 5-year intervals thereafter. Inspections shall be made only by competent persons and the results shall be recorded on a suitable data sheet, the completed copies of which shall be kept as a permanent record. The points to be recorded and checked on these date sheets are: Date of inspection (month and year); CTC specification number; cylinder identification (registered symbol and serial number, date of manufacture, and ownership symbol (if needed for adequate identification)); type cylinder protective coating (painted, etc., and statement as to need of refinishing or recoating); conditions checked (leakage, corrosion, gouges, dents or digs in shell or heads, broken or damaged footring or protective ring or fire damage); disposition of cylinders (returned to service, to cylinder manufacturer for repairs or scrapped); a cylinder which passes the inspection prescribed shall have the date recorded in the manner presently prescribed for the recording of the retest date, except that an 'E' is to follow the date (month and year) indicating requalification by the external inspection method.

(11) A cylinder made in compliance with specification CTC-3A, CTC-3A480X, or CTC-4AA480 used exclusively for anhydrous ammonia, commercially free from corroding components, and protected externally by suitable corrosion resisting coatings (such as painting, etc.) may be retested every 10 years instead of every 5 years.

(12) All cylinders not exceeding 2 inches outside diameter and length less than 2 feet are exempted from hydrostatic retest.

(13) In addition to the requirements of this paragraph (e), cylinders marked CTC-3HT must be requalified in accordance with CGA Pamphlet C-8 and must comply with the following:

(i) Cylinders shall be subjected, at least once in three years, to a test by hydrostatic pressure in a water jacket, for the determination of the expansion of the cylinder. A cylinder must be condemned if the elastic expansion exceeds the marked rejection elastic expansion.

(ii) A cylinder must be condemned if there is evidence of any denting or bulging.

(iii) A cylinder must be condemned at the termination of a 24-year period following the date of the original test or after 4,380 pressurizations, whichever occurs first. If a cylinder is recharged to more than an average of once every other day an accurate record of rechargings must be maintained by its owner or his agent.

(iv) Retest dates shall be applied by low stress type steel stamping to a depth no greater than that of the original marking at the time of manufacture. Stamping on sidewall not authorized.

(14) Cylinders made in compliance with specifications CTC-3A, 3AA, 3B, 4A, 4BA and 4BW, having service pressures up to and including 300 psi., used exclusively for methyl bromide, liquid, mixtures of methyl bromide and ethylene dibromide, liquid, mixtures of methyl bromide and chlorpicrin, liquid, mixtures of methyl bromide and petroleum solvents, liquid, or methyl bromide and non-flammable, non-liquefied compressed gas mixtures, commercially free from corroding components, and protected externally by suitable corrosion resisting coatings (such as galvanizing, painting, etc.) and internally by a suitable corrosion resisting lining (galvanized, etc.) may be retested decennially instead of quinquennially. All tests must be supplemented by a visual internal and external examination of the cylinder quinquennially. All tests must be supplemented by a very careful examination of the cylinder at each filling, and the cylinder must be rejected if evidence is found of bad dents, corroded areas, a leak or other conditions that indicate possible weakness which would render the cylinder unfit for service. Examination shall be as required by CGA Pamphlet C-6.

(15) A cylinder made in compliance with specification CTC-3A or 3AA, not exceeding 125 pounds water capacity and removed from any cluster, bank, group or rack each time it is filled, may be retested every 10 years instead of every 5 years, provided the cylinder complies with all of the following:

(i) The cylinder is not over 35 years old when it is retested.

[1] Use of existing cylinders authorized, but new construction not authorized.

(ii) The cylinder is used exclusively for: Air, argon, cyclopropane, ethylene, helium, hydrogen, krypton, neon, nitrogen, nitrous oxide, oxygen, xenon, and permitted mixtures thereof (see §73.301(a)) and permitted mixtures of these gases with up to 30 per cent by volume of carbon dioxide. These commodities must have a dewpoint at or below minus 52°F. at 1 atmosphere.

(iii) Prior to each refill, the cylinder is subjected to, and passes the hammer test specified in CGA Pamphlet C-6.

(iv) A cylinder currently in compliance with subdivisions (i), (ii), and (iii) of this subparagraph but which has not been confined to the exclusive use service specified since the last required hydrostatic retest is retested and examined in accordance with the requirements of §73.302(c)(2), (3), and (4) before the periodic retest interval is extended to 10 years.

(v) Each cylinder less than 35 years old is stamped with a five pointed star at least one-fourth of an inch high following the test date. If at any time a cylinder marked with the star is used other than as specified in this paragraph, the star following the most recent test date is obliterated and subsequent tests are made every 5 years.

(vi) The cylinder is dried immediately following hydrostatic testing to remove all traces of free water.

(vii) The cylinder is not used for underwater breathing.

(16) A cylinder that previously contained a commodity classified as a "corrosive liquid" must not be used for the transportation of any compressed gas unless the following requirements are complied with before the subsequent initial filling with the compressed gas.

(i) The cylinder must be visually inspected, internally and externally, in accordance withe the CGA Pamphlet C-6.

(ii) Regardless of the previous test or retest date, the cylinder must be tested by interior hydrostatic pressure and must meet the acceptance criteria as specified in subparagraphs (1), (2), (3), and (4) of this paragraph.

(iii) In addition to the record prescribed in subparagraph (5) of this paragraph, the record of the inspection and test shall include the date (month and year) of the inspection and test; the cylinder identification (including C.T.C., B.T.C., I.C.C., or D.O.T. specification number, registered symbol, serial number, date of manufacture, and ownership symbol); the conditions checked (leakage, corrosion, gouges, dents, or digs in shell or heads, broken or damaged footrings, or fire damage) and the disposition of the cylinder (returned to service, returned to the manufacturer for repairs, or scrapped).

(iv) A cylinder requalified for compressed gas service in accordance with this subparagraph may have its next retest and inspection scheduled from the date of the inspection and retest prescribed herein.

(v) A cylinder that contained any corrosive liquid, for which decontamination methods cannot remove all significant residue or impregnation by the former corrosive content must not be used for the transportation of any compressed gas.

(f) Cylinders subjected to the action of fire. A cylinder which has been subjected to the action of fire must not again be placed in service until it has been properly reconditioned as follows:

(1) A cylinder made of plain carbon steel with not over 0.25 per cent carbon nor over 0.90 manganese need not be reheat-treated but must pass the periodic retest requirements as specified in paragraph (e) of this section.

(2) CTC-8 cylinders made of plain carbon steel with not over 0.25 per cent carbon nor over 0.90 per cent manganese must be reinspected to determine the condition of the cylinder and the porous filling. If the cylinder is undamaged and the filler is unchanged and intact, the cylinder may be returned to service without reheat treatment or test.

(3) The inner cylinders made under specification CTC-4L may be used after again passing the original hydrostatic test.

(4) CTC-3AL and CTC-4E aluminum cylinders may not be reheat treated and must be removed from service.

(5) Other cylinders must be reheat treated and reconditioned as specified in paragraph (g) of this section.

(g) Reheat treatment.

(1) Previous to the reheat treatment procedure hereinafter prescribed, each cylinder must be subjected to a careful internal and external inspection.

(2) Cylinders must be segregated for reheat treatment in lots of 100 or less cylinders of the same general size having practically the same chemical composition.

(3) The reheat treatment operation must be carried out, supervised, and reported as prescribed for the heat treatment in the specification covering the manufacture of the cylinder in question. Data from the original reports of manufacture of the cylinders must be available.

(4) The reheat treatment must be followed by hydrostatic retest, such retest to be carried out, supervised, and reported as prescribed for the hydrostatic tests in the specification covering the manufacture of the cylinder in question. The results of the retest must meet either of the following conditions:

(i) The permanent expansion shall be from zero to 10 per cent of the total expansion in hydrostatic retest and one cylinder from each lot shall pass the requirements of the flattening and physical tests prescribed. Failure to pass the flattening or physical tests will reject the lot or;

(ii) The permanent expansion shall not be less than 3 percent nor more than 10 per cent of the total expansion in the hydrostatic retest, in which case the flattening and physical tests are not required. For this alternative method the hydrostatic retest pressure shall not exceed 115 per cent of the minimum prescribed test pressure except with specific approval of the Commission.

(h) Repair by welding or brazing of specifications CTC-3A, 3AA, 3B, 3C cylinders. Repair of specifications CTC-3A, 3AA, 3B or 3C cylinders by welding or brazing authorized, but only for the removal and replacement of neckrings and footrings attached to cylinders originally manufactured to conform to paragraph 9 of the specification to which the cylinder was built. Removal and replacement must be done by a regular manufacturer of this type of cylinder. After removal and before replacement of such parts, cylinders must be inspected, and defective ones rejected. Cylinders, neckrings, footrings, and method of replacement must conform to paragraph 9 of the specification to which the cylinder was built. Replacement must be followed by reheat treating, testing, inspection, and supervised and reported as prescribed by the specification covering their original manufacture. Inspector's reports must conform with that required by the specification covering original manufacture with the word "repaired" substituted for "manufactured". Show original markings and the

new additional markings added, and statement: "Cylinders were carefully inspected for defects after removal of neckrings and footrings and after replacement, which replacement was made by process of ....."
(welding-brazing)

(i) Repair by welding or brazing of CTC-4 series, and CTC-8, welded or brazed cylinders. Repairs on CTC-4 series and CTC-8 series welded or brazed cylinders are authorized to be made by welding or brazing. Such repairs must be made by a manufacturer of these types of CTC cylinders or by a repair facility authorized by the Commission and by a process similar to that used in its manufacture and under the following specific requirements:

(1) Cylinders with injurious defects in welded joints in or on pressure parts must be repaired by completely removing the defect prior to rewelding.

(2) Cylinders with injurious defects in brazed joints in or on pressure parts must be repaired by rebrazing.

(3) Cylinders during welding must be free of materials in contact with the welded joint that may impair the serviceability of the metal in or adjacent to the weld. (Precautions must be taken to prevent acetylene cylinder steels from picking up carbon during repair.)

(4) Neckrings, footrings, or other nonpressure attachments authorized by the specification may be replaced or repaired. Repair or replacement of footrings, neckrings, or other non-pressure attachments authorized by the specification for CTC-4BA and 8AL cylinders may be made without conforming to the requirements of subparagraph (i)(6) of this section provided the following requirements are met:

(i) Must be done by a manufacturer of these types of CTC cylinders or by a repair facility authorized by the Commission.

(ii) The welder shall have available to him information as to the procedure, equipment, and rod used during manufacture and shall use a similar method for repair.

(iii) Repairs must be by metal arc welding only. Welds shall be 3 inches maximum length and spaced at least 3 inches apart.

(iv) Welds shall not be made on or near brazed joint (to prevent the possibility of copper penetration.)

(v) After repair the welds are to be inspected visually for weld quality.

(vi) After repair the weld area is to be leak tested at the service pressure of the cylinder.

(5) After removal, and before replacement of attachments, cylinders must be inspected and defective ones rejected, repaired or rebuilt.

(6) After repair, cylinders must be reheat-treated, tested, inspected and reported when and as prescribed by the specification covering their original manufacture when welding or brazing seams in a pressure part of a cylinder; or when welding or brazing on pressure parts of cylinders of plain carbon steels with carbon over 0.25 per cent or manganese over 1.00 per cent or of alloy steels except as provided in §73.34(i)(7).

NOTE 1: Heat-treatment is not required after welding or brazing weldable low carbon parts to attachments of similar material which has been previously welded or brazed to the top or bottom of cylinders and properly heat-treated, provided such subsequent welding or brazing does not produce a temperature in excess of 400°F. in any part of the top or bottom material.

(7) Repair of cylinders must be followed by a proof pressure leakage test at prescribed test pressure and visual examination for weld quality when welding on pressure parts of cylinders of plain carbon 0.25 per cent or less and manganese 1.00 per cent or less, or when repairing steel types 1315, NAX and GLX by the following procedure:

(i) Leakage through the welding metal may be repaired without subsequent reheat treatment of the cylinder.

(ii) Repair permitted only by either the metal arc or tungsten inert gas shielded arc process. E7015, 7016, or 7018 electrodes not larger than 1/8 inch diameter shall be used for the metal arc process.

(iii) Weld defects must be removed by grinding or chipping before repair by the metal arc process. The tungsten inert gas shielding arc process may be used for repair only when such repair can be made by puddling. Repair weld shall not exceed 1 inch in length nor be closer than 3 inches to the next repair area.

(iv) Repair of weld defects which have any cracking is not permitted.

(j) Repair of non-pressure attachments. Repair of non-pressure attachments by welding or brazing without affecting a pressure part of the cylinder must be followed by visual examination for weld quality.

(k) Prohibited repairs. Walls, heads or bottoms of cylinders with injurious defects or leaks in base metal shall not be repaired, but may be replaced as provided for in paragraph (l) of this section.

(l) Rebuilding of CTC-4 series and CTC-8, welded or brazed cylinders. Rebuilding of CTC-4 series and CTC-8 series, welded or brazed cylinders is authorized. Such rebuilding must be done by a manufacturer of these types of CTC cylinders or by a repair facility authorized by the Commission and by a process similar to that used in its original manufacture and under the following specific requirements:

(1) The replacement of a pressure part such as wall, heads, or bottoms of cylinders or the replacement of the porous filling material, shall be considered as rebuilding.

(2) Rebuilt cylinders shall be considered as new cylinders and shall conform to all the requirements of the specifications applying, including verification of material, examination, inspection, etc., and the rendering of the proper reports to the purchaser, cylinder rebuilder, and the Commission. Report must show that cylinders were rebuilt.

(3) Information in sufficient detail regarding previous serial numbers and identification symbols must be filed with the Commission.

SUBPART B — EXPLOSIVES

§ 73.51 Forbidden explosives. (a) The offering of the following explosives for transportation by common carriers by rail freight, or rail express, is forbidden.

(b) Explosive compositions that ignite spontaneously or undergo marked decomposition when subjected for 48 consecutive hours to a temperature of 75°C. (167°F.).

(c) Explosives containing an ammonium salt and a chlorate.

(d) Liquid nitroglycerin, diethylene glycol dinitrate or other liquid explosives not authorized by §73.53 of this part.

(e) Explosives condemned by the Bureau of Explosives, the Commission, or the Explosives Division, Department of Energy, Mines and Resources, Ottawa (except properly packed

samples for laboratory examinations). Appeal may be made to the Commission from such condemnations.

(f) Leaking or damaged packages of explosives.

(g) Condemned or leaking explosives must not be repacked and offered for shipment unless the repacking is done by a competent person in the presence of, or with the written consent of the Director of Operation, Railway Transport Committee.

(h) Firecrackers, flash crackers, salutes, or similar commercial devices which produce or are intended to produce an audible effect, the explosive content of which exceeds 12 grains each in weight, and pest control bombs, the explosive content of which exceeds 18 grains each in weight; and any such devices, without respect to explosive content, which on functioning are liable to project or disperse metal, glass or brittle plastic fragments.

(i) Fireworks that combine an explosive and a detonator or blasting cap.

(j) Fireworks containing an ammonium salt and a chlorate.

(k) Fireworks containing yellow or white phosphorus.

(l) Fireworks or fireworks compositions that ignite spontaneously or undergo marked decomposition when subjected for 48 consecutive hours to a temperature of 75°C. (167°F.).

(m) Fireworks, properly condemned by the Bureau of Explosives, the Commission or the Explosives Division of the Department of Energy, Mines and Resources, except properly repacked samples for laboratory examinations.

(n) Toy torpedoes, the maximum outside dimension of which exceeds 7/8 inch, or toy torpedoes containing a mixture of potassium chlorate, black antimony and sulphur with an average weight of explosive composition in each torpedo exceeding four grains.

(o) Toy torpedoes containing a cap composed of a mixture of red phosphorus and potassium chlorate exceeding an average of one-half (0.5) grain per cap.

(p) Fireworks containing copper sulphate and a chlorate.

(q) New explosives and explosive devices except as provided for in §73.86.

(r) Loaded firearms.

(s) Flash crackers, salutes, cigarette loads, explosive auto alarms, toy propellant devices, toy smoke devices, and trick matches, alarms.

(t) The commercial product commonly known as Cobex.

§ 73.53 Acceptable explosives. No railway shall accept for transport any explosive which is not an authorized explosive as defined in the *Explosive Act,* R.S.C. c. E-15, unless the explosive has been authorized by the Committee for transport by rail.

§ 73.54 Ammunition. (a) Ammunition for cannon, or small arms, rockets, projectiles, grenades, bombs, mines and torpedoes must be well packed and properly secured in strong wooden, metal or fiberglass resin containers or other Commission approved containers.

(b) Detonating fuzes, tracer fuzes, explosive or ignition devices, bouchons, or fuze parts with explosives contained therein, must not be assembled in explosive projectiles, grenades, explosive bombs, explosive mines or explosive torpedoes, or included in the same outside package with them unless approved by the Commission.

(c) Explosive projectiles, explosive torpedoes, explosive mines, explosive bombs, or explosive grenades except as provided in paragraph (d) of this section, must be packed and properly secured in strong wooden or metal boxes.

(d) Explosive projectiles, explosive torpedoes, explosive mines or explosive bombs, exceeding 90 pounds in weight, and explosive projectiles may be shipped, without being boxed only by, for, or to the Department of National Defence when securely blocked and braced in accordance with methods approved by the Commission.

(e) The gross weight of a box containing more than one projectile, mine, grenade, or bomb must not exceed 250 pounds.

(f) Explosive bombs packed more than one in shipping containers having gross weight not in excess of 1400 pounds may be shipped by, for or to the Department of National Defence.

(g) Articles described in this section must not be offered for transportation by rail express, except as provided in §73.86.

§ 73.55 Ammunition, nonexplosive. (a) Nonexplosive ammunition is defined as a device which contains no explosives or other dangerous commodities, such as cartridge cases, dummy or drill cartridges; empty, sand loaded or solid projectiles with or without tracers (containing not in excess of one ounce of tracer composition), empty mines, empty bombs, solid projectiles, empty torpedoes, or practice bombs. It also includes devices containing no explosives, or other dangerous commodities, except installed electric squibs, primers, propellants or thermal batteries required for the activation of the device, provided that it has been proven by test that when initiated the full energy release is contained within the outside shipping container. Such ammunition is exempt from these Regulations. Rotating bands should be protected against deformation by method of packing or loading.

§ 73.60 Black powder. (a) Black powder must be packed in containers complying with the following specifications:

(1) Spec. 10B. Wooden barrels or kegs. Not over 200 pounds gross weight.

(2) Spec. 13. Metal kegs, not less than 7 inches long. Net weight not less than 6¼ pounds nor more than 150 pounds.

(3) Bundles of metal kegs, spec. 13, firmly tied together with rope and wrapped in strong burlap, canvas, or similar material, securely sewed and roped, authorized. Net weight of powder must no exceed 100 pounds.

(4) Spec. 14, 15A, or 16A. Wooden boxes with inside containers which must be spec. 13, metal kegs, or fibre or metal containers not over 1½ pounds capacity each, or cotton bags of at least 4 ounce cotton duck not over 25 pounds capacity each. The gross weight of spec. 14 boxes not to exceed 140 pounds and the gross weight of spec. 15A or 16A boxes not to exceed 200 pounds.

(5) Spec. 14, 15A, or 16A. Wooden boxes with inside cylindrical fiber cartridges not over 5 inches diameter nor over 18 inches long with fibre at least 0.05 inch thick paraffined on outer surface with joints securely glued or cemented, or strong paraffined paper cartridges not over 12 inches long authorized only for compressed pellets (cylindrical block) 7/8 inch or more in diameter. Boxes must be completely lined with strong paraffined paper or other suitable waterproof material without joints or other openings at the bottom or sides. Authorized gross weight not to

exceed 75 pounds.

(6) Spec 12H, 23F, or 23H. Fibreboard boxes with inside cylindrical fibre cartridges not over 5 inches diameter nor over 18 inches long with fibre at least 0.05 inch thick paraffined on outer surface with joints securely glued or cemented, or strong paraffined paper cartridges not over 12 inches long authorized only for compressed pellets (cylindrical block) 7/8 inch or more in diameter. Authorized gross weight not to exceed 65 pounds.

(7) Spec. 14, 15A, or 16A. Wooden boxes with inside containers which must be cloth or paper bags of capacity not exceeding 25 pounds net weight, provided the completed shipping package shall be capable of standing a drop of 4 feet without rupture of inner or outer containers. The completed package must not exceed 50 pounds, net weight, of black powder.

(8) Spec. 12H, 23F, or 23H. Fibreboard boxes with inside containers which must be cloth, paper, or securely closed polyethylene bags constructed of material not less than 0.004 inch thick of capacity not exceeding 25 pounds net weight for cloth or paper bags not exceeding 50 pounds net weight for polyethylene bags, or inside fibre or metal containers having not over 1 pound capacity each, provided the completed shipping package shall be capable of withstanding a drop of 4 feet without rupture of inner or outer containers. The tubes of the box may be eliminated and a single tube as specified in Spec. 23F may be substituted. The completed package shall not contain more than 50 pounds net weight of black powder.

(9) Spec. 17E. Metal drums (single-trip), not over 5 gallons capacity each, without opening except bunghole not exceeding 2.3 inches in diameter. Authorized for carload shipments only.

(c) Black pellet powder primed with an electric squib secured inside the coaxial hole of the pellet powder with loose ends of the wires of the squib effectively short-circuited may be shipped in containers complying with the following specifications:

(1) Spec. 14, 15A, or 16A. Wooden boxes with inside cartridges which must be strong paraffined paper cartridges not over 12 inches long authorized only for compressed pellets (cylindrical block) 7/8 inch or more in diameter. Boxes must be lined as prescribed for cylindrical fibre cartridges. Gross weight not to exceed 65 pounds.

(f) Black powder must not be offered for transportation by rail express, except as provided in §73.86.

§ 73.61 High explosives. (a) High explosives except gelatin dynamite, when offered for transportation by rail freight must not contain in excess of 60 per cent of liquid explosive ingredient.

(1) High explosives consisting of a liquid mixed with an absorbent material must have the absorbent (wood pulp or similar material) in sufficient quantity and of satisfactory quality, properly dried at the time of mixing; nitrate of soda must be dried at the time of mixing to less than 1 per cent of moisture; and the ingredients must be uniformly mixed so that the liquid will remain thoroughly absorbed under the most unfavorable conditions incident to transportation.

(2) High explosives containing nitroglycerin or other liquid explosive ingredients must have uniformly mixed with an absorbent material a satisfactory antacid, which must be in quantity sufficient to have the acid neutralizing power of an amount of magnesium carbonate equal to 1 per cent of the nitroglycerin or other liquid explosive ingredient. This does not apply to Monobel No. 7 or Monobel X (Eq. S.).

(3) Cartridges shall consist of a column of explosives completely enclosed in a shell made of strong paper or polyethylene or a combination of paper and polyethylene, so treated that it will not absorb the liquid ingredient of the explosive.

(4) Bags shall be made of strong paper or equally efficient material so treated or of such nature that it will not absorb the liquid ingredient of the explosive.

(5) All boxes in which high explosives are packed must be lined with strong paraffined paper or other suitable material, except as provided in this section. Lining must be without joints or other openings or with cemented joints at the bottom, ends, or sides of boxes, and for explosives with liquid ingredients must be impervious to such ingredient and also to water. Covers of boxes must be protected from contact with explosives by lining paper or other suitable material. (See spec. 2L, for authorized lining material.)

(6) Before cartridges or bags of gelatin explosives are packed in boxes, lined in accordance with paragraph (f) of this section, dry fine wood pulp or sawdust at least 1/4 inch in depth must be spread over the bottom of box or bottom of box may have a full area pad formed of absorptive cellulose sheet having nitroglycerin absorptive value equivalent to sawdust as specified; similar materials are required in boxes for packing all non-gelatinous types of explosives containing 30 per cent or more liquid explosive ingredient.

(7) Except for cartridges containing gelatin dynamite, all cartridges of high explosives exceeding 4 inches in length and containing more than 10 per cent of a liquid explosive ingredient must be placed horizontally in boxes. Bags must be packed with their filling holes up.

(8) Movement of cartridges and bags of high explosives within the boxes shall be prevented by sufficiently tight packing.

(9) High explosives, except gelatin dynamite, packed in bags or in cartridges in excess of 2 inches in diameter and containing not more than 30 per cent liquid explosive ingredients may be packed in outside containers without sawdust and without lining paper provided either each inside or outside container is siftproof and is so treated as to prevent penetration by the commodity with which the container is filled for shipping.

(b) High explosives, liquid, must be packed in specification containers as follows:

(1) Spec. 15L. Wooden boxes with metal, glass or plastic inside containers so cushioned as to withstand an impact of 8 m.p.h.

(2) Spec. 15M. Wooden boxes. Metal inside containers shall contain not more than 10 quarts liquid explosives each and shall be so cushioned as to withstand an impact of 8 m.p.h.

(c) High explosive with liquid explosive ingredient containing not more than 30 per cent liquid explosive ingredients must be prepared as prescribed in this section, except as otherwise specified, and packed in containers complying with the following specifications:

(1) Spec. 23G. Fibreboard boxes. Not more than one cartridge in each box. High explosives packed in boxes consisting of more than one tube joined circumferentially are exempt from the requirements of paragraphs (a)(5) and (a)(6) of this section. High explosives packed in boxes consisting of one tube closed at the ends are exempt from the requirements of paragraphs (a)(3), (a)(5) and (a)(6) of this section. Gross weight of boxes not to exceed 65 pounds.

(2) Spec. 14, 15A, or 16A. Wooden boxes, or spec. 12H, 23F, or 23H, fibreboard boxes, with inside containers which must be cartridges not exceeding 12 inches in diameter or 50 pounds in weight with length not to exceed 36 inches, or bags not exceeding 50 pounds each securely closed so as to prevent leakage therefrom. Gross weight of wooden boxes not to exceed 75 pounds and gross weight of fibreboard boxes not to exceed 65 pounds.

(3) Spec. 23F or 23H. Fibreboard boxes having one inside 26-gauge metal container, measuring not over 8 inches in diameter and 31 inches long, containing high explosives (ammonium dynamite core) surrounded by nitrocarbonitrate. Authorized gross weight not to exceed 65 pounds.

(d) High explosives containing 10 per cent or less of a liquid explosive ingredient in cartridges or bags as prescribed in subparagraphs (a)(3) and (a)(4) may be packed in wooden boxes, spec. 14, 15A, or 16A, gross weight not to exceed 140 pounds, or fibreboard boxes, spec. 12H, 23F or 23H, gross weight not to exceed 65 pounds.

(1) High explosives containing 10 per cent or less of a liquid explosive ingredient may be packed in fibreboard boxes, spec. 23G. Not more than one cartridge in each box. High explosives packed in boxes consisting of more than one tube joined circumferentially are exempt from the requirements of subparagraphs (a)(5) and (a)(6) of this section. High explosives packed in boxes consisting of one tube closed at the ends are exempt from the requirements of subparagraphs (a)(3), (a)(5) and (a)(6) of this section. Gross weight of boxes not to exceed 65 pounds.

(e) High explosives containing more than 30 per cent liquid explosive ingredients must be prepared as prescribed in subparagraphs (a)(1) to (a)(8), inclusive, of this part, except as otherwise specified, and in containers complying with the following specifications:

(1) Spec. 14, 15A or 16A wooden boxes or spec. 12H, 23F, or 23H fibreboard boxes. Inside containers must consist of:

(i) Cartridges not exceeding 4 inches in diameter and not exceeding 8 inches in length.

(ii) Cartridges exceeding 4 inches in diameter and not exceeding 5 inches in diameter and between 8 inches and not exceeding 10 inches in length must be redipped in melted paraffin or equivalent material.

(iii) Two or more cartridges that must be redipped because of their size must be enclosed in another strong paper shell to form a completed cartridge not exceeding 30 inches in length. The resulting cartridge must be dipped in melted paraffin or equivalent material.

(iv) Gross weight of wooden boxes not to exceed 75 pounds and gross weight of fibreboard boxes not to exceed 65 pounds.

(2) Spec. 14, 15A, or 16A, wooden boxes, or spec. 12H, 23F, or 23H, fibreboard boxes, with inside containers which must be paraffined two-ply paper bags not exceeding 12½ pounds capacity, securely closed by folding the tops and securing the fold by tape, with not more than two such bags inserted into another two-ply paper bag which must be securely closed and dipped in paraffin after closing, or with not more than two inside containers which must be securely closed polyethylene bags not less than 0.004″ in thickness of not more than 12½ pounds capacity each packed in a securely closed polyethylene or paper bag and packed in polyethylene lined outside fibreboard boxes. Gross weight of wooden boxes not to exceed 75 pounds and gross weight of fibreboard boxes not to exceed 65 pounds.

(f) High explosives (gelatin dynamite and blasting gelatin) must be prepared as prescribed in subparagraphs (a)(1) to (a)(8) inclusive of this part, except as otherwise specified, and in containers complying with the following specifications:

(1) Spec. 23G. Fibreboard boxes. Not more than one cartridge in each box. High explosives packed in boxes consisting of more than one tube joined circumferentially are exempt from the requirement of subparagraphs (a)(5) and (a)(6) or when packed in boxes consisting of one tube closed at the ends are exempt from the requirements of subparagraphs (a)(3) to (a)(6) inclusive. Gross weight of boxes not to exceed 65 pounds.

(2) Spec. 14, 15A, or 16A. Wooden boxes, or spec. 12H, 23F, or 23H, fibreboard boxes, with inside containers which must be cartridges not exceeding 12 inches in diameter or 50 pounds in weight with length not to exceed 36 inches, or bags not exceeding 12½ pounds each. Bags if not completely sealed against leakage by method of closure must be packed with filling holes up. Gross weight of wooden boxes not to exceed 75 pounds and gross weight of fibreboard boxes not to exceed 65 pounds.

(3) High explosives (gelatin dynamite or blasting gelatin) may be shipped in a package consisting of not more than 6 cartridges of such explosives, each not exceeding 32 inches in length or 5 inches in diameter, cartridged with heavy paper in such manner as to have the approximate strength of a spec. 23G container, which cartridges shall in turn be placed in a 10-ply paper tube not exceeding 11 feet in length. The outer paper tube must be equipped with a metal cone or equally efficient device on one end which shall serve to close that end of the tube and to the metal cone shall be affixed a wire threaded through fibre tubes running through the centre of each of the 6 cartridges; or as an alternative to the single wire running through the cartridges in the outer tube at the centre, two wires may be applied, one on each side of the cartridges and between the outside of the cartridges and the inside of the outer tube. In either event, cartridges and the outer tube shall be securely closed so as to prevent spilling of any loose explosive under any conditions normally incident to transportation and cartridges shall be so loaded and stayed within the car to prevent damage to individual containers. The total gross weight of each completed package shall not exceed 125 pounds. Shipments are authorized in carload lots only without transfer of packages other than such transfers as may be necessary in the event of mechanical failure of the car in which originally loaded.

(g) High explosives (straight gelatin dynamites of 80 per cent strength and over and blasting gelatin) must be packed in cartridges or in bulk in outside boxes. When packed in bulk in boxes double lining paper throughout must be used. Containers must comply with the following specifications:

(1) Spec. 14, 15A, or 16A. Wooden boxes.

(2) Spec. 12H, 23F, 23G, or 23H. Fibreboard boxes. Spec. 23G must be packed in an outer container consisting of at least 7-ply heavy Kraft paper .

(3) Gross weight of wooden boxes not to exceed 75 pounds. Gross weight of fibreboard boxes not to exceed 65 pounds.

(h) High explosives with no liquid explosive ingredient and propellant explosives, division 1.1 and division 1.2. If their sensitiveness to percussion is not greater than that measured by the blow delivered by an 8-pound weight dropping from a distance of 7 inches on a compressed pellet of the explosive three-hundredths of an inch thick and two-tenths of an inch in diameter, confined rigidly between hard steel surfaces as in

the standard Impact Testing Apparatus of the Bureau of Explosives, must be packed in cartridges or in bags in outside boxes. They must be packed in cartridges when their sensitiveness is greater than the limit prescribed herein. Such explosives when dry may be packed in strong sift-proof cloth or paper bags of capacity not exceeding 25 pounds. These explosives must be packed in outside containers complying with the following specifications:

(1) Spec. 14, 15A, or 16A. Wooden boxes.

(2) Spec. 12H, 23F, or 23H. Fibreboard boxes.

(3) Spec. 10B. Wooden barrels or kegs.

(4) Gross weight of wooden boxes not to exceed 140 pounds. Gross weight of fibreboard boxes not to exceed 65 pounds.

(5) When such explosives contain over 5 per cent moisture, boxes must be lined with strong paraffined paper or other authorized material, spec. 2L.

(6) When such explosives are in combination cartridges, consisting of column of explosives with core of dynamite, they may be shipped when packed in outside boxes with 65 pounds as the maximum gross weight. The column of explosives must be completely enclosed in waterproofed cloth or strong waterproofed paper and must not exceed 6 inches in diameter, 20 inches in length, or gross weight of 25 pounds.

(7) Spec. 23G. Fibreboard boxes. Such explosives when packed in boxes consisting of more than one tube joined circumferentially are exempt from requirements of subparagraphs (a)(5) and (a)(6) of this section or when packed in boxes consisting of one tube closed at the ends are exempt from requirements of subparagraphs (a)(3) to (a)(6) inclusive, of this part. The gross weight of boxes not to exceed 65 pounds.

(i) High explosives containing no liquid explosive ingredient nor any chlorate if their sensitiveness to percussion is not greater than that measured by the blow delivered by an 8 pound weight dropping from a distance of 7 inches on a compressed pellet of the explosive three-hundredths of an inch thick and two-tenths of an inch in diameter, confined rigidly between hard steel surfaces as in the standard Impact Testing Apparatus of the Bureau of Explosives, must be packed in cartridges, or in bags or metal containers in outside boxes, except that the requirement of packaging in cartridges, bags or metal containers does not apply to plastic-bonded explosives, but they must be packed and cushioned so as to prevent movement of individual pieces within the outside shipping container. They must be placed in cartridges when their sensitiveness is greater than the limit prescribed in this section. Such explosives when dry may be packed in strong sift-proof bags securely closed so as to prevent leakage therefrom or metal containers of capacity not exceeding 60 pounds. These explosives must be packed in outside containers complying with the following specifications:

(1) Spec. 14, 15A, or 16A. Wooden boxes.

NOTE 1: Wooden boxes, having inside metal containers which are tightly and securely closed, may be equipped with hand holes in each end which must be not more than one inch by four inches and centred laterally not nearer than 1⅝ inches from top edge of end of box.

(2) Spec. 12H, 23F, or 23H. Fibreboard boxes.

(3) Spec. 10B. Wooden barrels or kegs.

(4) Gross weight of wooden boxes not to exceed 140 pounds. Gross weight of fibreboard boxes not to exceed 65 pounds.

(5) When such explosives contain over 5 per cent moisture, boxes must be lined with strong paraffined paper or other authorized material, spec. 2L.

(6) When such explosives are in combination cartridges, consisting of column of explosives with core of dynamite, they may be shipped when packed in outside boxes with 65 pounds as the maximum gross weight. The column of explosives must be completely enclosed in waterproofed cloth or strong waterproofed paper and must not exceed 6 inches in diameter, 20 inches in length, or gross weight of 25 pounds.

(7) Spec. 23G. Fibreboard boxes. Such explosives when packed in boxes consisting of more than one tube joined circumferentially are exempt from requirements of subparagraphs (a)(5) and (a)(6) of this section or when packed in boxes consisting of one tube closed at the ends are exempt from requirements of subparagraphs (a)(3) to (a)(6) inclusive of this section. The gross weight of boxes not to exceed 65 pounds.

(j) Amatol consisting of 80 per cent ammonium nitrate and 20 per cent trinitrotoluene, ammonium picrate, nitroguanidine, nitrourea, urea nitrate, picric acid, tetryl, trinitroresorcinol, trinitrotoluene, pentolite, cyclotrimethylenetrinitramine (desensitized), and soda amatol, in dry condition in addition to containers prescribed in paragraphs (i)(1) to (5) and (7) of this section, may be shipped in containers complying with the following specifications:

(1) Spec. 14, 15A, or 16A. Wooden boxes with strong paper or cloth bags of capacity not exceeding 50 pounds, packed with filling holes up.

(2) Spec. 21C. Fibre drums. Net weight not to exceed 200 pounds.

(k) Trinitrotoluene and pentolite, in dry condition, in addition to containers prescribed in paragraphs (i)(1) to (5) and (j)(1) and (2) of this section, may be shipped in specification containers as follows:

(1) Spec. 14, 15A, or 16A. Wooden boxes with strong paper or cloth bags of capacity not exceeding 100 pounds, packed with filling holes up.

(2) Spec. 14, 15A, or 16A. Wooden boxes with strong siftproof liners, spec. 2L.

(l) The following materials may be shipped dry, in quantity not exceeding 4 ounces in one outside package for medicinal purposes or as reagents, by carriers by rail freight or rail express, as drugs, medicines, or chemicals, without other restrictions, when in securely closed bottles or jars properly cushioned to prevent breakage:

(1) Ammonium picrate
(2) Dipicrylamine
(3) Dipicryl sulphide
(4) Dinitrophenylhydrazine
(5) Nitroguanidine
(6) Picramide
(7) Picric acid
(8) Picryl chloride
(9) Trinitroanisole
(10) Trinitrobenzene
(11) Trinitrobenzoic acid
(12) Trinitro-m-cresol
(13) Trinitronaphthalene
(14) Trinitroresorcinol
(15) Trinitrotoluene
(16) Urea nitrate

(m) Ammonium picrate, cyclotrimethylenetrinitramine, pentaerythrite tetranitrate (desensitized), picric acid, trinitrobenzene, trinitrobenzoic acid, trinitroresorcinol, trinitrotoluene, or urea nitrate, when wet with not less than 10 pounds of water to each 90 pounds of dry material must be shipped in packaging as follows:

(1) Spec. 10B. Wooden barrel or keg. Not over 42 gallons nominal capacity. Not authorized for wet desensitized pentaerythrite tetranitrate.

(2) (See § 73.192 for shipments of wet ammonium picrate, wet picric acid, wet trinitrobenzoic acid, and wet urea nitrate not in excess of 16 ounces and § 73.193 for shipments of wet picric acid, wet trinitrobenzoic acid, and wet urea nitrate not in excess of 25 pounds.) (See § 73.212 for shipments of wet trinitrobenzene and wet trinitrotoluene not in excess of 16 ounces.)

(3) Spec. 5B. Metal barrels or drums or Spec. 21C fibre drums. Authorized only for cyclotrimethylenetrinitramine wet with not less than 10 pounds of water to each 90 pounds of dry material in inside containers which must be bags made of at least 10-ounce cotton duck, rubber or rubberized cloth and securely closed. The dry weight of cyclotrimethylenetrinitramine in one metal barrel or drum must not exceed 300 pounds and not more than 255 pounds in fibre drums. These bags containing the cyclotrimethylenetrinitramine must then be placed in a rubber bag, rubberized cloth or bag made of suitable water-tight material which must be securely closed and then placed in the drum. If shipment of cyclotrimethylenetrinitramine is to take place at a time freezing weather is to be anticipated, it must be wet with a mixture of denatured ethyl alcohol or other suitable anti-freeze and water of such proportions that freezing will not occur in transit.

(4) Spec. 21C. Fibre drum with an inside polyethylene bag having 0.004 inch minimum thickness and liquid-tight closure. Net weight not to exceed 200 pounds. Authorized only for wet desensitized pentaerythrite tetranitrate.

(n) Amatol when cast or pressed in a block or column, in addition to the containers prescribed in paragraphs (a)(1) to (5) and (7) of this section, may be shipped in specification containers as follows:

(1) Spec. 13A. Metal drums not exceeding 90 pounds gross weight.

(o) Nitrocellulose must be packed in wooden boxes complying with specs. 14, 15A, or 16A, with inside packages which must be:

(1) Inside packages containing not more than 1 pound each of dry, uncompressed nitrocellulose, wrapped in strong paraffined paper or suitable sparkproof material. Completed outside package not to contain more than 10 pounds dry nitrocellulose.

(2) Inside packages containing compressed sticks or blocks of dry nitrocellulose wrapped in strong paraffined paper. Gross weight not to exceed 75 pounds.

(p) Shaped charges, commercial, having exposed lined conical cavities must have such cavities effectively filled; those having conical cavities that are covered shall be paired together with the cavities facing each other and with one or more pairs in a fibre tube, or so arranged that the conical cavities of the shaped charges at the ends of the column face toward the centre of the tube. The shaped charges in the fibre tubes must fit snugly with no excess space and the fibre tubes containing the shaped charges must be packed snugly with no excess space in the outside containers. Other methods of packaging for devices of which shaped charges are a component part may be employed when approved by the Commission or the Bureau of Explosives. Shaped charges, commercial, must be packed in specification containers as follows:

(1) Spec. 14, 15A, or 16A. Wooden boxes. Gross weight not to exceed 140 pounds.

(2) Spec. 12H, 23F, or 23H. Fibreboard boxes. Gross weight not to exceed 65 pounds.

(3) Spec. 12B. Fibreboard boxes which must be manufactured of at least 275-pound strength (Mullen or Cady test) double-wall corrugated fibreboard and shall be provided with double-faced corrugated lining board (See par. 15, spec. 12B) having minimum strength (Mullen or Cady test) of 200 pounds. Individual charges of explosives shall be packed in inside securely closed, waterproof plastic containers, or in securely closed waterproof fibreboard containers having metal ends. Gross weight not to exceed 65 pounds. Inside individual containers shall be separated by means of double-faced corrugated fibreboard partitions of material not less than 175-pound Mullen or Cady test.

(q) Cyclotrimethylenetrinitramine (desensitized) in pellet form, dry, in addition to provisions of paragraphs (a) and (b) of this section may be packed in specification containers as follows:

(1) Spec. 15A. Wooden boxes. For pellets 1/4 inch or less in diameter; pellets must be packed in a slide-type fibre carton with perforated fillers. All openings of the fibre carton shall be securely closed with pressure-sensitive tape. Inside containers shall be cushioned with at least 2 inches of sawdust between inner containers and outside box. No inside container shall contain more than one-half pound net weight of explosive composition and not more than 10 pounds net weight of explosive composition shall be packed in one outside box.

(2) Spec. 15A. Wooden boxes. For pellets exceeding 1/4 inch in diameter; pellets must be packed in a fibre tube with positive closures at both ends, which shall be packed in a fibre carton having not more than one-half pound net weight of explosive composition. Fibre carton shall be cushioned with not less than 2 inches of sawdust in the outside box. Not more than 10 pounds net weight of explosive composition shall be packed in one outside box.

(r) High explosives covered by this section must not be offered for transportation by rail express, except as provided in § 73.86.

§ 73.66 Blasting caps, blasting caps with safety fuse, blasting caps with metal clad mild detonating fuse, and electric blasting caps.

(b) The outside of all blasting caps and electric blasting caps must be free from fulminate or other explosive compositions.

(c) Blasting caps containing not more than 50 grains of explosive composition each must be placed in strong interior containers, in which they must fit snugly. When caps are loaded vertically in interior metal containers, they must be covered by a suitable elastic material. Not more than 100 such blasting caps may be packed in a single container. All inside containers must then be packed snugly in cartons or wrappings made of paper or pasteboard.

(d) Note more than 5,000 blasting caps, not exceeding 50 grains of explosive composition each, packed in inner containers as prescribed in paragraph (c) of this section, must be packed in outside containers complying with the following specifications:

(1) Spec. 14, 15A, or 16A. Wooden boxes (see § 73.67 (a)(1), Note 1) or spec. 12H, 23F, or 23H, fibreboard boxes, with inside containers which must be cartons or wrappings with inside containers as prescribed in paragraph (c) of this section, which must be separated from the outside box by at least one inch of tightly packed sawdust, excelsior, or equivalent cushioning material. Gross weight not to exceed 150 pounds.

(e) More than 5,000 blasting caps, not exceeding 50 grains of

explosive composition each, packed in inner containers as prescribed in paragraph (c) of this section, must be packed in outside containers complying with the following specifications:

(1) Spec. 14, 15A, or 16A. Wooden boxes (see § 73.67 (a)(1), Note 1) or spec. 12H, 23F, or 23H, fibreboard boxes, with inside containers which must be cartons or wrappings with inner containers as prescribed in paragraph (c) of this section, packed in an inside box made of sound lumber, a hermetically sealed metal box of metal not less than 30 gauge United States standard, or a sealed package made of 6 ply Sisalkraft Asphalt Laminated sheeting, or its equivalent; Asphalt Laminated sheeting shall consist of 2 plies of strong fibres, 2 plies of pliable asphalt, and 2 plies or protective cover. The minimum tensile strength shall be 20 pounds per inch width in each direction. The laminated sheet shall have a minimum water resistance of 24 hours and a maximum water permeability of 4 grams per square meter per 24 hours. This inside wooden box, metal box, or sealed package must be separated at all points from the outside box by at least one inch of tightly packed sawdust, excelsior, or equivalent cushioning material. Gross weight not to exceed 150 pounds.

(2) More than 20,000 blasting caps containing not more than 50 grains of explosive composition each, must not be placed in one outside package.

(f) Blasting caps containing in excess of 50 grains of explosive composition each must be packed in containers complying with the following specifications:

(1) Spec. 14, 15A, or 16A. Wooden boxes (see § 73.67 (a)(1) Note 1, of this part) with inside containers which must have strong interior containers, in which they must fit snugly. When caps are loaded vertically in interior metal containers, they must be covered by suitable elastic material placed over the caps. Not more than 10 such blasting caps may be packed in a single inside container. All inside containers must then be packed snugly in cartons or wrappings made of paper or pasteboard. The cartons or wrappings must be separated from outside box by at least 1 inch of tightly packed sawdust, excelsior, or equivalent cushioning material. Not more than 500 caps containing in excess of 50 grains of explosive composition each may be placed in one outside package. Gross weight not to exceed 150 pounds.

(g) Electric blasting caps must be packed in containers complying with the following specifications:

(1) Spec. 14, 15A, or 16A. Wooden boxes, or spec. 12H, 23F or 23H fibreboard boxes, with inside containers which must be pasteboard cartons containing not more than 100 caps each, or pasteboard tube enclosing each cap with wires or with the wires wrapped around the tube. Gross weight of 103 pounds authorized for spec. 12H boxes when constructed of 350-pound test corrugated fibreboard in accordance with 8(a)(3). Gross weight of wooden boxes containing pasteboard cartons or caps with wires 30 feet or more in length in pasteboard tubes must not exceed 150 pounds, except for export shipment. Gross weight of wooden boxes containing caps with wires less than 30 feet in length in pasteboard tubes must not exceed 75 pounds.

(i) Blasting caps and electric blasting caps must not be offered for transportation by rail express, except as provided in § 73.86.

Blasting caps with safety fuse and blasting caps with metal clad mild detonating fuse. Ten or less of the interior containers of not more than 100 blasting caps each, containing not to exceed 50 grains of explosive composition each, packed as prescribed in § 73.66 (c), in the same outside container with safety fuse or metal clad mild detonating fuse, must be shipped in containers complying with the following specifications:

(1) Spec. 14, 15A, or 16A. Wooden boxes (see Note 1 of this paragraph) or spec. 12H, 23F or 23H, fibreboard boxes, with inside containers which must be cartons or wrappings with inner containers as prescribed in § 73.66 (c), placed in the centre of a coil of fuse and secured and cushioned therein to prevent movement therefrom. Gross weight not to exceed 150 pounds.

NOTE 1: Closing of outside boxes by nailing tops in place with uncoated nails, at not over 3-inch centres into ends, and at not over 6-inch centres into sides, is authorized. Sizes of these nails must be not less than the following:

1 1/4 inch into ends and sides not over 3/8 inch thick,
1 1/2 inch into ends and sides over 3/8 but not over 1/2 inch thick.
1 3/4 inch into ends and sides over 1/2 but not over 5/8 inch thick.
2 inch into ends and sides over 5/8 but not over 13/16 inch thick.
2 1/4 inch into ends and sides over 13/16 inch thick.

(i) Blasting caps, blasting caps with safety fuse, blasting caps with metal clad mild detonating fuse, and electric blasting caps must not be offered for transportation by rail express, except as provided in § 73.86.

§ 73.68 Detonating primers. (a) Detonating primers must be packed in containers complying with the following specifications;

(1) Spec. 14, 15A, or 16A. Wooden boxes (see § 73.67 (a)(1), Note 1) or spec. 12H, 23F or 23H, fibreboard boxes, with inside containers which must be pasteboard cartons containing not more than 50 primers each, or pasteboard or plastic tube enclosing each primer with wires, or pasteboard, wooden, metal, or plastic tubes or spools with wires wrapped around the tube or spool. Gross weight of wooden boxes containing pasteboard cartons must not exceed 150 pounds, except for export shipment. Gross weight of wooden boxes containing pasteboard or plastic tube enclosing each primer with wires, or pasteboard, wooden, metal, or plastic tubes or spools with the wires wrapped around the tube or spool must not exceed 75 pounds.

(c) Detonating primers must not be offered for transportation by rail express, except as provided in § 73.86.

§ 73.69 Detonating fuzes, division 1.1 or division 1.2 with or without radioactive components, detonating fuze parts containing an explosive, boosters, bursters, or supplementary charges. (a) Detonating fuze, division 1.1 or division 1.2 with or without radioactive components, detonating fuze parts containing an explosive, boosters, bursters and supplementary charges when shipped not assembled in projectiles, bombs, etc. shall be packed and well secured in strong tight wooden or metal boxes.

NOTE 1: Fuses with radioactive components are subject to § 73.389 to § 73.390.

(b) The gross weight of one outside package containing detonating fuzes, division 1.1 or division 1.2, shall not exceed 190 pounds. Boosters, bursters and supplementary charges, without detonators, when shipped separately, shall not exceed a gross weight of 300 pounds.

(d) Detonating fuzes, division 1.1 or division 1.2 boosters, bursters or supplementary charges shall not be offered for transportation by rail express, except as provided in § 73.86.

§ 73.70 Diazodinitrophenol or lead mononitroresorcinate. (a) The offering of diazodinitrophenol or lead mononitroresorcinate in a dry condition for transportation by common carriers by rail freight, or rail express, is forbidden, except as a component of manufactured articles such as percussion caps, detonators, blasting caps, and exploders, the transportation of which is au-

thorized in this part.

(b) Diazodinitrophenol or lead mononitroresorcinate must be packed wet with not less than 40 per cent by weight of water in specification containers 5 or 5B metal barrels or drums or 10B wooden barrels or kegs, with inside containers which must be bags made of at least 10-ounce cotton duck, rubber, or rubberized cloth, which must be securely closed. The dry weight of diazodinitrophenol in one container must not exceed 220 pounds and the dry weight of lead mononitroresorcinate in one container must not exceed 100 pounds. The bags containing diazodinitrophenol or lead mononitroresorcinate must be placed in a rubber bag, rubberized cloth bag, or bag made of suitable watertight material and then placed in the barrel, keg, or drum. Any empty space in the outside bag must be filled with water and this bag securely closed.

(1) Spec. 21C. Fibre drums not over 25 gallons capacity of at least nine-ply construction having, in addition, a sheet of steel having a minimum base box of 75 pounds, not less than .008 inch thick, wound between the fifth and sixth plies. The inside ply of kraft paper shall be laminated on each side with polyethylene to form a waterproof lining. The bottom head shall be of fibre, metal covered on the outside. Lead mononitroresorcinate only must be packed wet with not less than 40 per cent by weight of water and shall be contained in at least two tightly sealed polyethylene bags of at least 0.004 inch thickness and this unit shall then be placed in a tightly closed polyethylene bag of at least 0.004 inch thickness and this assembly shall be placed within a 0.006 inch thickness polyethylene or other suitable plastic bag, completely filled with water and tightly closed. The 0.006 inch plastic bag shall be of such size as to completely fill the outside shipping container. The dry weight of lead mononitroresorcinate only in one outside container must not exceed 100 pounds.

(c) Sufficient outage in outside container must be allowed to prevent rupturing of container in freezing weather, or a mixture of denatured alcohol and water may be used to prevent freezing in transit.

(e) Diazodinitrophenol or lead mononitroresorcinate, wet, must not be offered for transportation by rail express, except as provided in § 73.86.

§ 73.71 Fulminate of mercury. (a) The offering of fulminate of mercury in a dry condition for transportation by common carriers by rail freight, or rail express, is forbidden, except as a component of manufactured articles such as percussion caps, detonators, blasting caps, and exploders, the transportation of which is authorized in this part.

(b) Fulminate of mercury must be packed wet with not less than 25 per cent by weight of water in specification containers 5 or 5B metal barrels or drums, 17H metal drums (single-trip), or 10B wooden barrels or kegs, with inside container which must be a bag made of 4-ounce duck. Inside the bag and over the fulminate there must be placed a cap of the same fabric, of the same diameter as the bag. The bag must be securely tied and placed in a strong grain bag. This grain bag must also be securely tied. The dry weight of fulminate in one containers must not exceed 150 pounds. The bag and contents must be packed in the centre of the wooden barrel or keg, metal barrel or drum, and must be entirely surrounded by not less than 3 inches of well-packed sawdust saturated with water. The wooden barrel or keg, or metal barrel or drum, must be lined with a heavy, close-fitting, jute bag closed by secure sewing to prevent escape of sawdust. The barrel, keg or drum must be inspected carefully and all leaks stopped.

(c) If shipment of fulminate is to take place at a time that freezing weather is to be anticipated, a mixture of denatured ethyl alcohol and water of such proportions that freezing will not occur in transit must be used.

(e) Fulminate of mercury, wet, must not be offered for transportation by rail express, except as provided in § 73.86.

§ 73.72 Guanyl nitrosamino guanylidene hydrazine. (a) The offering of guanyl nitrosamino guanylidene hydrazine in a dry condition for transportation by common carriers by rail freight, or rail express, is forbidden, except as a component of manufactured articles such as percussion caps, detonators, blasting caps, and exploders, the transportation of which is authorized in this part.

(b) Guanyl nitrosamino guanylidene hydrazine must be packed wet with not less than 30 per cent by weight of water in specification containers 5 or 5B metal barrels or drums, 17H metal drums (single-trip), or 10B wooden barrels or kegs, with inside container which must be a bag made of 4-ounce duck. Inside the bag and over the guanyl nitrosamino guanylidene hydrazine there must be placed a cap of the same fabric, of the same diameter as the bag. The bag must be securely tied and placed in a strong grain bag. This grain bag must also be securely tied. The dry weight of guanyl nitrosamino guanylidene hydrazine in one container must not exceed 75 pounds. The bag and contents must be packed in the centre of the wooden barrel or keg, metal barrel or drum, and must be entirely surrounded by not less than 3 inches of well-packed sawdust saturated with water. The wooden barrel or keg, or metal barrel or drum, must be lined with a heavy, close-fitting, jute bag closed by secure sewing to prevent escape of sawdust. The barrel, keg, or drum must be inspected carefully and all leaks stopped.

(c) If shipment of guanyl nitrosamino guanylidene hydrazine is to take place at a time that freezing weather is to be anticipated, a mixture of denatured ethyl alcohol and water of such proportions that freezing will not occur in transit must be used.

(e) Guanyl nitrosamino guanylidene hydrazine, wet, must not be offered for transportation by rail express, except as provided in § 73.86.

§ 73.73 Azides of heavy metals. (a) The offering of azides in a dry condition for transportation by common carriers by rail freight, or rail express, if forbidden, except as a component of manufactured articles such as percussion caps, detonators, blasting caps, and exploders, the transportation of which is authorized in this part.

(b) Azides, dextrinated type, or otherwise prepared to effectively control grain size, must be packed wet with not less than 20 per cent by weight of water in specification containers 5 or 5B metal barrels or drums, 17H metal drums (single-trip), or 10B wooden barrels or kegs, with inside container which must be a bag made of 4-ounce duck. Inside the bag and over the azides there must be placed a cap of the same fabric, of the same diameter as the bag. The bag must be securely tied and placed in a strong grain bag. This grain bag must also be securely tied. The dry weight of azides in one container must not exceed 150 pounds. The bag and contents must be packed in the centre of the wooden barrel or keg, metal barrel or drum, and must be entirely surrounded by not less than 3 inches of well-packed sawdust saturated with water. The

wooden barrel or keg, or metal barrel or drum, must be lined with a heavy, close-fitting, jute bag closed by secure sewing to prevent escape of sawdust. The barrel, keg, or drum must be inspected carefully and all leaks stopped.

(c) If shipment of azides is to take place at a time that freezing weather is to be anticipated, a mixture of denatured ethyl alcohol or other suitable antifreeze and water of such proportions that freezing will not occur in transit must be used.

(e) Azides, wet, must not be offered for transportation by rail express, except as provided in § 73.86.

§ 73.74 Lead styphnate. (a) The offering of lead styphnate (lead trinitroresorcinate) in a dry condition for transportation by common carriers by rail freight, or rail express, is forbidden, except as a component of manufactured articles such as percussion caps, detonators, blasting caps, and exploders, the transportation of which is authorized in this part.

(b) Lead styphnate (lead trinitroresorcinate) must be packed wet in with not less than 20 per cent by weight of water in specification containers 5 or 5B metal barrels or drums, 17H metal drums (single-trip), or 10B wooden barrels or kegs, with inside container which must be a bag made of rubber cloth. The lead styphnate within this bag should be divided into a number of smaller packages. There must be a cap of the same fabric and of the same diameter as the bag over the lead styphnate and inside the bag. The dry weight of lead styphnate in one outer container must not exceed 150 pounds. The bag and contents must be packed in the centre of the wooden barrel or keg, metal barrel or drum, and must be entirely surrounded by not less than 3 inches of well-packed sawdust saturated with water. The wooden barrel or keg, or metal barrel or drum, must be lined with a heavy, close-fitting, jute bag closed by secure sewing to prevent escape of sawdust. The barrel, keg, or drum must be inspected carefully and all leaks stopped.

(c) If shipment of lead styphnate is to take place at a time freezing weather is to be anticipated, it must be wet with a mixture of denatured ethyl alcohol and water of such proportions that freezing will not occur in transit.

(e) Lead styphnate (lead trinitroresorcinate), wet, must not be offered for transportation by rail express, except as provided in § 73.86.

§ 73.75 Nitro mannite. (a) The offering of nitro mannite in a dry condition for transportation by common carrier by rail freight, or rail express, is forbidden, except as a component of manufactured articles such as percussion caps, detonators, blasting caps, and exploders, the transportation of which is authorized in this part.

(b) Nitro mannite must be packed wet with not less than 40 per cent by weight of water in specification containers 5 or 5B metal barrels or drums, or 10B wooden barrels or kegs, with inside containers which must be bags made of at least 10-ounce cotton duck, rubber or rubberized cloth, which must be securely closed. The dry weight of nitro mannite in one container must not exceed 100 pounds. These bags containing the nitro mannite must then be placed in a rubber bag, rubberized cloth bag or bag made of suitable watertight material and then placed in the barrel, keg, or drum. Any empty space in the outside bag must be filled with water and this bag securely closed.

(1) Spec. 21C. Fibre drums not over 25 gallons capacity of at least nine-ply construction having, in addition, a sheet of steel having a minimum base box of 75 pounds, not less than .008 inch thick, wound between the fifth and sixth plies. The inside ply of kraft paper shall be laminated on each side with polyethylene to form a waterproof lining. The bottom head shall be of fibre, metal covered on the outside. Nitro mannite must be packed wet with not less than 40 per cent by weight of water and shall be contained in at least two tightly sealed polyethylene bags of at least 0.004 inch thickness and this unit shall then be placed in a tightly closed polyethylene bag of at least 0.004 inch thickness and this assembly shall be placed within a 0.006 inch thickness polyethylene or other suitable plastic bag, completely filled with water and tightly closed. The 0.006 inch plastic bag shall be of such size as to completely fill the outside shipping container. The dry weight of nitro mannite in one outside container must not exceed 100 pounds.

(c) Sufficient outage in outside container must be allowed to prevent rupturing of container in freezing weather, or a mixture of denatured ethyl alcohol and water may be used to prevent freezing in transit.

(e) Nitro mannite, wet, must not be offered for transportation by rail express, except as provided in § 73.86.

§ 73.76 Nitrosoguanidine. (a) The offering of nitrosoguanidine in a dry condition for transportation by common carriers by rail freight, or rail express, is forbidden except as a component of manufactured articles such as percussion caps, detonators, blasting caps, and exploders, the transportation of which is authorized in this part.

(b) Nitrosoguanidine must be packed wet with not less than 10 per cent by weight of water in specification containers 5 or 5B metal barrels or drums, 17H metal drums (single-trip), or 10B wooden barrels or kegs, with inside container which must be a bag made of strong cloth, which must in turn be placed in the wooden barrel, or keg, or metal barrel or drum. The dry weight of nitrosoguanidine in one container must not exceed 75 pounds.

(d) Nitrosoguanidine, wet, must not be offered for transportation by rail express, except as provided in § 73.86.

§ 73.77 Pentaerythrite tetranitrate. (a) The offering of pentaerythrite tetranitrate in a dry condition for transportation by common carriers by rail freight, or rail express, is forbidden, except as a component of manufactured articles such as percussion caps, detonators, blasting caps, and exploders, the transportation of which is authorized in this part.

(b) Pentaerythrite tetranitrate must be packed wet with not less than 25 per cent by weight of water in specification containers 5 or 5B metal barrels or drums, 17H metal drums (single-trip), or 10B wooden barrels or kegs, with inside containers which must be bags made of at least 10-ounce cotton duck, rubber, or rubberized cloth, which must be securely closed. The dry weight of pentaerythrite tetranitrate in one container must not exceed 300 pounds. These bags containing the pentaerythrite tetranitrate must then be placed in a rubber bag, rubberized cloth bag, or bag made of suitable watertight material and then placed in the barrel, keg, or drum. Any empty space in the outside bag must be filled with water and this bag securely closed.

(c) Sufficient outage in outside container must be allowed to prevent rupturing of container in freezing weather, or a mixture of denatured ethyl alcohol or other suitable anti-freeze and water may be used to prevent freezing in transit.

(e) Pentaerythrite tetranitrate, wet, must not be offered for

transportation by rail express, except as provided in § 73.86.

§ 73.78 Tetrazene. (a) The offering of tetrazene (guanyl nitrosamino guanyl tetrazene) in a dry condition for transportation by common carriers by rail freight, or rail express, is forbidden, except as a component of manufactured articles such as percussion caps, detonators, blasting caps, and exploders, the transportation of which is authorized in this part.

(b) Tetrazene (guanyl nitrosamino guanyl tetrazene) must be packed wet with not less than 30 per cent by weight of water in specification containers 5 or 5B metal barrels or drums, 17H metal drums (single-trip), or 10B wooden barrels or kegs, with inside container which must be made of 4-ounce duck. Inside the bag and over the tetrazene there must be placed a cap of the same fabric, of the same diameter as the bag. The bag must be securely tied and placed in a strong grain bag. This grain bag must also be securely tied. The dry weight of tetrazene in one container must not exceed 75 pounds. The bag and contents must be packed in the centre of the wooden barrel or keg, metal barrel or drum, and must be entirely surrounded by not less than 3 inches of well packed sawdust saturated with water. The wooden barrel or keg, or metal barrel or drum, must be lined with a heavy, close-fitting, jute bag closed by secure sewing to prevent escape of sawdust. The barrel, keg, or drum must be inspected carefully and all leaks stopped.

(c) If the shipment of tetrazene is to take place at a time that freezing weather is to be anticipated, it must be wet with a mixture of denatured ethyl alcohol and water of such proportions that freezing will not occur in transit.

(e) Tetrazene (guanyl nitrosamino guanyl tetrazene), wet, must not be offered for transportation by rail express, except as provided in § 73.86.

§ 73.79 Jet thrust units (jato) division 1.1 and division 1.2 explosives; rocket motors, division 1.1 and division 1.2 explosives; igniters, jet thrust (jato), division 1.1 and division 1.2 explosives; and igniters, rocket motor division 1.1 and division 1.2 explosives.

(a) Division 1.1 and division 1.2 explosives listed in this section shall be packaged in outside packagings which comply with one of the following specifications:

(1) Spec. 14, 15A, 15E, or 16A wooden boxes or wooden boxes, fibreboard lined, or

(2) wooden boxes, wooden crates, or other packagings of military specifications which comply with § 73.7(a), or other packagings approved by the Committee.

(b) Jet thrust units (jato), division 1.1 and division 1.2 explosives or rocket motors, division 1.1 and division 1.2 explosives, shall not be shipped with ignitors assembled therein unless shipped by, for, or to the Department of National Defence.

(c) Jet thrust units (jato), division 1.1 and division 1.2 explosives and rocket motors, division 1.1 and division 1.2 explosives, may be packaged in the same outside packaging with separately packaged igniters (or igniter components), Division 1.1, 1.2, 1.3 or 1.4 explosives only if the packagings are approved by the Committee or comply with subsection 73.7(a).

(e) Division 1.1 and division 1.2 explosives listed in this section shall not be transported by rail express, except as provided in section 73.86.

§ 73.86 Samples of explosives and explosive articles. (a) New explosives, including fireworks and explosive devices must be examined and approved by the Commission as safe for transportation before being offered for shipment, except that a sample of such explosives, fireworks and explosive devices, not to exceed 5 pounds net weight, may be offered for transportation by carriers by rail freight for this examination. Samples of explosives, except liquid nitroglycerin, other than new explosives for laboratory examination not exceeding 5 pounds net weight may be offered for transportation by carriers by rail freight. For the purpose of these regulations a new explosive, including fireworks and explosive devices, is the product of a new factory or an explosive or explosive device of an essentially new composition or character made by any factory.

(b) Before being offered for shipment, explosive articles in the experimental state must be made safe by removal of ignition elements or otherwise.

(d) Samples of explosives and explosive articles for transportation by rail freight, or rail express. Samples of explosives (except liquid nitroglycerin), including fireworks and explosive devices for examination in a laboratory only and not intended for use of demonstration, may be offered for transportation by rail freight or rail express provided they fulfill the following requirements (see Note 1):

(1) Samples of explosives including fireworks and explosive devices for laboratory examination must be packed in well-secured metal cans, glass bottles, rubber containers, or compatible plastic containers not subject to static generation by contained products, or in strong water-proof paper or cardboard packages; each sample must consist of not more than one-half pound of explosive, and the interior package must be placed in sawdust or similar cushioning material, at least 2 inches thick, in a wooden box, spec. 14 or 15A.

(2) Whenever these samples of explosives for laboratory examination are contained in a metal envelope or receptacle, this receptacle must be properly cushioned with sawdust or similar cushioning material in a strong wooden box, and this interior box must be packed in a wooden box, spec. 14 or 15A, with at least 2 inches of cushioning material separating the boxes.

(3) Not more than 100 blasting caps may be shipped in one outside package for laboratory examination, and they must be packed and cushioned as provided in paragraph (d)(2) of this section.

(4) Not more than 20 half-pound samples of explosives for laboratory examination may be packed in one outside package or transported in a single car or vehicle at one time.

(5) The net weight of the explosive contents must be plainly marked by the shipper on the outside of each box offered for transportation.

(6) Each package containing a sample of an explosive for laboratory examination must be clearly marked on the outside of the package with the words "SAMPLE FOR LABORATORY EXAMINATION".

NOTE 1: The maximum weight of any sample of wet initiating or primary explosive that may be packed in one outside box or transported in any one train is four (4) ounces, (wet weight).

§ 73.87 Explosives in mixed packing. (a) Unless specifically authorized by these regulations explosives must not be packed in the same outside package with each other or with other articles. Explosives, except blasting caps and other initiating explosives, in separate interior containers, may be shipped when packed in

the same outside package of gross weight not exceeding 50 pounds, provided the weight of any interior package of explosives does not exceed 8 ounces, and provided the interior packages are so cushioned and protected as to insure their transportation without rupture or leakage of contents.

§ 73.89 Ammunition for cannon with empty projectiles, inert-loaded projectiles, solid projectiles, or without projectiles or shell. (a) Ammunition for cannon with empty projectiles, inert-loaded projectiles, solid projectiles, or without projectiles or shell, must be well packed and properly secured in strong wooden or metal containers.

(c) Ammunition for cannon with empty projectiles, inert-loaded projectiles, solid projectiles, or without projectiles or shell, must not be offered for transportation by rail express, except as provided in § 73.86.

§ 73.90 Rocket ammunition with empty, inert-loaded, or solid projectiles. (a) Rocket ammunition with empty, inert-loaded, or solid projectiles must be well packed and properly secured in strong wooden or metal containers.

(c) Rocket ammunition must not be offered for transportation by rail express, except as provided in § 73.86.

§73.91 Special fireworks and related articles. (a) Special fireworks, except as otherwise authorized, must be securely packed in containers complying with the following specifications:

(1) Spec. 11B. Strong, tight, sparkproof wooden barrels.

(2) Spec. 15A, 15B, 16A, or 19A. Wooden boxes. Gross weight not to exceed 500 pounds.

(3) Spec. 12B. Fibreboard boxes. Gross weight not to exceed 65 pounds except as provided in paragraph (a)(5) of this section. Not permitted for illuminating projectiles and aeroplane flares.

(4) Fireworks that can be exploded en masse, by dropping the completed shipping container from a height of six feet or by the impact of a rifle bullet, if found safe for transportation, may be shipped in accordance with the regulations in this part by applying to high explosives.

(5) Ship distress signals when packed in tight inside metal containers of not less than 24 gauge sheet iron or other metal of equal strength, securely closed by positive means (not friction) and of such design and so arranged as to completely fill the outside container, may be packed in spec. 12B fibreboard boxes. Gross weight not to exceed 95 pounds when boxes are made in accordance with paragraph 29 of Spec. 12B.

(6) Illuminating projectiles, incendiary projectiles, and smoke projectiles exceeding 90 pounds in weight each, or of not less than 4½ inches in diameter, may be shipped without being boxed only by, for or to the Department of National Defence when securely blocked and braced in accordance with methods prescribed by the cognizant military Department and approved by the Commission.

(7) Illuminating projectiles, incendiary projectiles, and smoke projectiles less than 4½ inches in diameter may be shipped without being boxed, when palletized, only by, for or to the Department of National Defence when securely blocked and braced in accordance with methods prescribed by the cognizant military Department and approved by the Commission.

(b) Flash or spreader cartridges not exceeding 72 grains of flash powder each must be packed in containers complying with the following specifications:

(i) Spec. 15A, 15B, 16A, or 19A. Wooden boxes, or spec. 12B fibreboard boxes, with inside containers which must be cartons or tin cans containing not over 6 cartridges and not to exceed 150 cartons or cans to an outer box.

(c) Flash cartridges consisting of a paper cartridge shell, small arms primer, and flash composition, not exceeding 180 grains each, all assembled in one piece ready for firing must be packed in containers complying with the following specifications:

(1) Spec. 15A, 15B, 16A, or 19A. Wooden boxes, or spec. 12B fibreboard boxes, with inside containers which must be cartons containing not to exceed 12 cartridges each and not more than 12 such cartons in one outside box.

(2) Flash cartridges, in quantity not exceeding 5 pounds, when in small interior wooden boxes, may be packed with nonexplosive, nonflammable, or noncorrosive articles.

(d) Flash sheets must be packed in containers complying with the following specifications:

(1) Spec. 15A, 15B, 16A, or 19A. Wooden boxes, or spec. 12B fibreboard boxes, with inside containers which must be an inner package or envelope containing not more than 6 flash sheets and not more than one dozen inner envelopes or packages enclosed in each inner pasteboard box or carton. Gross weight of wooden box not to exceed 150 pounds. Gross weight of fibreboard box not to exceed 65 pounds.

(2) Flash sheets, in quantity not exceeding 5 pounds, when in small interior wooden boxes, may be packed with nonexplosive, nonflammable, or noncorrosive articles.

(e) Photographic flash powder must be packed in containers complying with the following specifications:

(1) Spec. 15A, 15B, 16A, or 19A. Wooden boxes, or spec. 12B fibreboard boxes, with inside containers which must be sufficiently strong to retain contents not exceeding 2 ounces each. If bottles are used, each bottle must be packed in a securely closed fibre mailing tube having metal ends. Not more than 4 dozen 2-ounce bottles may be packed in an outer wooden box. When packed in units not exceeding 1 ounce each without bottles in similar fibre mailing tubes and outer wooden boxes, the gross weight of one outside box must not exceed 150 pounds. Gross weight of fibreboard box not to exceed 65 pounds.

(2) Photographic flash powder, in quantity not exceeding 5 pounds, when in small interior wooden boxes, may be packed with nonexplosive, nonflammable, or noncorrosive articles.

(f) Railway torpedoes (track torpedoes) must be packed in containers complying with the following specifications:

(1) Spec. 15A, 15B, 16A, 19A, or 19B. Wooden boxes. Net weight not to exceed 125 pounds.

(2) Spec. 12H, 23F, or 23H. Fibreboard boxes. Gross weight not to exceed 65 pounds.

(3) Spec. 12B. Fibreboard boxes, with inside containers which must be cartons containing not to exceed one-half gross track torpedoes each. Gross weight of outside fibre-board box not to exceed 65 pounds.

(4) Spec. 12B. Fibreboard boxes without inside containers may be used for not more than 50 track torpedoes provided the smallest dimension of the box is not less than 6 inches.

(g) Toy torpedoes must be securely packed as prescribed in this section in containers complying with the following specifications:

(1) Spec. 15A, 15B, 16A, or 19A wooden boxes, or spec. 12B fibreboard boxes which must be constructed to comply with paragraph 30 of specification 12B. Not more than 20 one-quarter gross cartons are authorized per fibreboard box. Gross weight of fibreboard box must not exceed 25 pounds. Gross weight of wooden box must not exceed 65 pounds.

(2) Toy torpedoes of any kind must not be packed with other fireworks.

(3) Toy torpedoes containing a cap must be packed in sawdust, in inside paper or cardboard cartons. The size of the carton must be not less than 4 cubic inches for each grain of explosive.

(4) Toy torpedoes containing a mixture of potassium chlorate, black antimony and sulphur, must be packed in an inner container, containing not more than one-fourth gross. The capacity of this inner container must be not less than 105 cubic inches, and it must be divided into 12 equal compartments. All vacant space inside the container must then be filled with sawdust or fine shavings.

(5) The gross weight of a container of toy torpedoes must not exceed 65 pounds.

(h) Except as otherwise specified in this section the gross weight of one outside container of special fireworks must not exceed 500 pounds.

(j) (Cancelled).

§ 73.92 Jet thrust units (jato), division 1.3 explosives; rocket motors, division 1.3 explosives; igniters, jet thrust (jato), division 1.3 explosives; igniters, rocket motors, division 1.3 explosives; and starter cartridges, jet engine, division 1.3 explosives. (a) Division 1.3 explosives listed in this section shall be packaged in outside packaging which comply with one of the following specifications:

(1) Spec. 14, 15A, 15E, or 16A wooden boxes, or wooden boxes, fibreboard lined,

(2) Spec. 15B wooden boxes. (Authorized only for igniters, jet thrust, division 1.3 explosives, or igniters, rocket motors, division 1.3 explosives),

(3) Spec. 23F fibreboard boxes. (Authorized only for igniters, jet thrust, division 1.3 explosives; igniters, rocket motor, division 1.3 explosives; or starter cartridges, jet engine, division 1.3 explosives). Items shall be packaged in tightly closed inside fibreboard boxes (at least 200-pound), or

(4) Wooden boxes, wooden crates, or other packagings of approved military specification which comply with § 73.7(a), or are approved by the Committee.

(b) Jet thrust units, division 1.3 explosives, or rocket motors, division 1.3 explosives, must not be shipped with igniters assembled therein unless shipped, by, for, or to the Department of National Defence.

(c) Jet thrust units, division 1.3 explosives, or rocket motors, division 1.3 explosives, may be packaged in the same outside packaging with separately packaged igniters (or igniter components), division 1.1, 1.2, 1.3 or 1.4 explosives, only if the packagings are approved by the Committee, or comply with § 73.7(a).

§ 73.93 Propellant explosives (solid) for cannon, small-arms, rockets, guided missiles, or other devices, and propellant explosives (liquid). (a) Propellant explosives (solid) for cannon, small-arms, rockets, guided missiles or other devices, when offered for transportation by carriers by rail freight, must be packed in containers complying with the following specifications (see paragraphs (g)(1) and (g)(2) of this section).

(1) Spec. 10B. Wooden barrels or kegs. Gross weight not to exceed 200 pounds.

(2) Spec. 13. Metal kegs at least 8 inches long. Gross weight not to exceed 150 pounds.

(3) Bundles of metal kegs, spec. 13, firmly tied together with rope and wrapped in strong burlap, canvas, or similar material, securely sewed and roped, are authorized. Net weight of propellant explosives must not exceed 100 pounds.

(4) Tight metal cases in tight wooden boxes free from loose knots and cracks or tight metal containers. Gross weight not to exceed 200 pounds.

(5) Spec. 14 or 15A. Wooden boxes, metal-lined, spec. 2F. Gross weight not to exceed 200 pounds.

(6) Spec. 14 or 15A wooden boxes, or spec. 23F or 23H fibreboard boxes, with inside containers which must be cloth or paper bags, of capacity not exceeding 25 pounds, net weight, each capable of withstanding, when filled to shipping content, at least two drops on end from a height of 4 feet, without breakage or sifting of contents. Outside container not to exceed more than 50 pounds, net weight.

(7) Spec. 14, 15A, 15B, or 15C wooden boxes, or spec. 12B, 23F, or 23H fibreboard boxes, with inside containers which must be spec. 13 metal kegs. Spec. 12B fibreboard boxes shall contain not more than 6 metal kegs not over 5 pounds net weight each in one ~~o~~utside box. Gross weight not to exceed 200 pounds in wooden boxes or 65 pounds in fibreboard boxes.

(8) Spec. 14, 15A, 15B, or 15C wooden boxes, or spec. 12H, 23F, or 23H fibreboard boxes, with inside containers which must be fibre or metal containers of not more than 1½ pounds capacity each. Gross weight not to exceed 200 pounds in wooden boxes or 65 pounds in fibreboard boxes.

(9) Spec. 14, 15A, 15B, or 15C wooden boxes, or spec. 23F or 23H, fibreboard boxes, with inside containers which must not exceed four metal containers, spec. 2A, of not more than 25 pounds each. Gross weight in fibreboard boxes not to exceed 65 pounds.

(10) Spec. 21C. Fibre drum. Each drum having any wooden head must be provided with a strong, sift-proof liner. Net weight may not exceed 225 pounds. Shipment by rail freight is prohibited except in trailer-on-flat-car service.

(11) Spec. 14, 15A, or 16A. Wooden boxes, not lined, authorized only for grains not less than 1-inch in diameter or 3 inches in length, provided such grains are tightly packed and are coated with a protective material. Gross weight not to exceed 200 pounds.

(12) Propellant explosives packed in any manner other than as specifically provided for in this paragraph must be in containers approved by the Commission or the Bureau of Explosives.

(b) Propellant explosives (smokeless powder for cannon or small-arms) in water when offered for transportation by carriers by rail freight must be packed in containers complying with the following specifications:

(1) Spec. 5, 5A, 5B, 6A, 6B, or 6C. Metal barrels or drums.

(2) Spec. 10A or 10B. Wooden barrels or kegs.

(3) Spec. 15A. Wooden boxes, metal-lined, spec. 2F.

(c) Igniters composed of black powder may be included in

shipments of propellant explosives.

(d) Propellant explosives (unstable, condemned, or deteriorated smokeless powder for cannon or small-arms) must be packed submerged in water in containers complying with the following specifications:

(1) Spec. 5, 5A, 5B, 6A, 6B, or 6C. Metal barrels or drums.

(2) Spec. 10A or 10B. Wooden barrels or kegs.

(3) Spec. 15A. Wooden boxes, metal-lined, spec. 2F.

(4) Spec. 103, 103W, or 111A100-W-1. Tank cars.

(5) Propellant explosives (unstable, condemned, or deteriorated smokeless powder for cannon or small-arms) must not be offered for transportation by rail express.

(e) Propellant explosives (liquid), when offered for transportation by rail freight, must be packed in containers complying with the following specifications (see § 73.93(g) for shipments by rail express):

(1) Spec. 15A, 15B, or 15E. Wooden box or wooden box fibreboard lined, with inside polyethylene bottles having taped screwcap closures, not over 1 gallon capacity each. Each bottle must be entirely contained within a polyethylene or other suitable plastic bag formed of material not less than 0.004 inch thickness, with ends securely closed. Each bottle in the plastic bag shall be enclosed in a tight metal container and be surrounded on all side with at least 2 inches of incombustible cushioning material; cans in the outside box must likewise be cushioned from each other and sides, top, and bottom of the container.

(2) Spec. 5B, 6A, 6B, 6C, 6D; also 17C or 17H (single-trip containers). Metal barrel or drum, with inside spec. 2S polyethylene drum, packed inside a strong, tight metal drum securely closed, or with inside glass-lined aluminum carboy not over 10 gallons capacity. Inside steel drum or glass-lined aluminum carboy must be surrounded on all sides with at least 2 inches of incombustible absorbent cushioning material uniformly distributed. Polyethylene drums are authorized only for liquids that will not react dangerously with the plastic or result in container failure.

(3) Outage requirements. Containers must not be entirely filled. Sufficient interior space must be left vacant to prevent leakage or distortion of containers due to the expansion of the contents from increase of temperature during transit.

(4) Propellant explosives (liquid) packed in any manner other than as specifically provided for in this paragraph must be in containers approved by the Commission.

(g) Propellant explosives when offered for transportation by rail express shall be packed as follows (also authorized for transportation by carriers by rail freight),

(1) Solids in tightly closed metal cans or fibre containers, not exceeding 1 pound each, or in inside metal cans or fibre containers containing not more than one grain of propellant, not exceeding 5 pounds each, and liquids, in polyethylene bottles compatible with contained liquid, with screwcap closures taped, not exceeding 1 pound or 16 fluid ounces capacity each, packed in outside wooden box, spec. 15A, 15B, or 15C; or outside fibre board box, spec. 12B, 23F, or 23H. Not more than 1,000 small-arms primers packed in inside containers as prescribed by § 73.107 may be included in one outside shipping container with solid propellant explosives. Inside containers must be packed so as to prevent movement within the outside container. Not more than 10 pounds of propellant explosives may be shipped in one outside container.

(2) (Cancelled).

§ 73.94 Explosive power devices, Division 1.3. (a) Explosive power devices, Division 1.3, shall not be shipped with igniters assembled therein unless approved by the Committee. Explosive power devices, division 1.3, shall be packed in outside containers which comply with one of the following specifications:

(1) Spec. 14, 15A, 15E, or 16A. Wooden boxes or wooden boxes, fibreboard lined,

(2) Strong wooden or metal boxes or containers. Authorized only for shipments made by, for, or to the Department of National Defense,

(b) Explosive power devices, division 1.3, packed in any other manner shall be in containers of a type approved by the Committee.

(d) (Cancelled).

§ 73.95 Rocket engines (liquid), division 1.3 explosives. (a) Rocket engines (liquid), division 1.3 explosives shall not be shipped with igniters or initiators assembled therein unless authorized by the Committee. Rocket engines shall be packed in outside container which complies with one of the following specifications:

(1) Spec. 14, 15A, 15E, or 16A wooden boxes or wooden boxes, fibreboard lined.

(2) Wooden boxes or metal containers of approved military specifications which comply with § 73.7(a).

(b) Rocket engines (liquid), division 1.3 explosives, may be packed in the same outside shipping container with separately packaged igniters, jet thrust, Division 1.3 explosives when authorized by appropriate Military Commands (see § 73.51(q)), or when containers are approved by the Committee.

(d) Rocket engines (liquid), division 1.3 explosives shall not be offered for transportation by rail express except as approved in § 73.86.

§ 73.101 Small-arms ammunition. (a) Small-arms ammunition must be packed in pasteboard or other inside boxes, or in partitions designed to fit snugly in the outside container, or must be packed in metal clips. The partitions and metal clips must be so designed as to protect the primers from accidental injury. The inside boxes, partitions and metal clips must be packed in securely closed strong outside wooden or fibreboard boxes or metal containers. Blank Industrial Power Load cartridges, similar to the 22 long rimfire cartridge, may be packed in bulk in securely closed fibreboard boxes.

(b) Small-arms ammunition in pasteboard or other inside boxes, in addition to containers prescribed in paragraph (a) of this section, may be shipped when packed in the same outside container with nonexplosive and nonflammable articles; or with small-arms primers or percussion caps in quantity not to exceed 5 pounds. The weight of the small-arms ammunition packed with other articles must not exceed 55 pounds in outside fibreboard box, or 75 pounds in outside wooden box. The outside package must be a securely closed strong wooden or fibreboard container.

(e) No restrictions, other than proper description, packing and marking for small-arms ammunition and additional marking

and labelling for tear gas cartridges are prescribed in this part for the transportation of small-arms ammunition and tear gas cartridges.

(f) Shipments of small-arms ammunition, including broken lots which have lost their identity (lot number identification) may be shipped loosely packed in securely closed strong wooden boxes or metal boxes, in carload lots, when shipments are made by or for the Department of National Defence to depots or manufacturing plants for reprocessing or demilitarization. Seriously deteriorated ammunition or ammunition damaged to the point of exposing incendiary or tracer composition, spillage or propellant powder, or ammunition with other hazardous defects must not be shipped.

§ 73.101a Cartridges, practice ammunition. (a) Cartridges, practice ammunition must be packaged in pasteboard or other inside boxes, or in partitions designed to fit snugly in the outside packaging, or must be packed in metal clips. The partitions and metal clips must be so designed as to protect the primers from accidental injury. The inside boxes, partitions, and metal clips must be packaged in securely closed strong outside wooden or fibreboard boxes or metal packagings.

§ 73.102 Explosive devices division 1.4. (a) Explosive cable cutters, explosive power devices, division 1.4, explosive release devices, or starter cartridges, jet engine, division 1.4, shall be packed in containers which comply with one of the following specifications:

(1) Spec. 12H, 23F, or 23H. Fibreboard boxes. (Authorized gross weight not to exceed 65 pounds), or

(2) Strong wooden or metal boxes, or other containers approved by the Committee.

(b) Starter cartridges, jet engine shall have igniter wires short-circuited when packed for shipment.

§ 73.104 Cordeau detonant fuse, mild detonating fuse, metal clad or flexible linear shaped charges, metal clad. (a) Cordeau detonant fuse, mild detonating fuse, metal clad or flexible linear shaped charges, metal clad must not be packed in the same package with detonators or with any high explosive.

(b) Cordeau detonant fuse, mild detonating fuse, metal clad or flexible linear shaped charges, metal clad, must be packed in wooden or fibreboard boxes.

§ 73.105 Percussion, tracer, combination, time fuzes and tracers. (a) Percussion, tracer, combination, time fuzes and tracers must be packed in strong, tight, outside wooden boxes or spec. 23F fibreboard boxes, with special provision for securing individual packages of fuzes or tracers against movement in the box.

(b) The gross weight of one outside wooden box must not exceed 150 pounds, and the gross weight of one outside fibreboard box must not exceed 65 pounds.

§ 73.106 Cartridge bags, empty, with black powder igniters, igniters, safety squibs, electric squibs, delay electric igniters, igniter fuse, metal clad, and fuse lighters or fuse igniters. (a) Cartridge bags, empty, with black powder igniters, igniters, safety squibs, electric squibs, delay electric igniters, igniter fuse, metal clad, and fuse lighters or fuse igniters must be packed in strong fibreboard or wooden boxes or wooden or metal barrels or drums properly described and properly marked with the name of the article packed therein.

§ 73.107 Primers, percussion caps, and empty grenades, primed. (a) Primers (cannon, combination and small arms), percussion caps, and empty grenades, primed, must be packed in strong, tight, outside wooden boxes, except as otherwise provided herein, with special provision for securing individual packages against movement in the box.

(b) Empty cartridge cases, primed, must be packed in strong, tight, outside wooden or fibreboard boxes.

(c) Small-arms primers containing anvils must be packed in cellular inside packages, with partitions separating the layers and columns of the primers, so that the explosion of a portion of the primers in the completed shipping package will not cause the explosion of all the primers. They must be packed as prescribed in paragraph (a) of this section or in spec. 12B fibreboard boxes, and equipped with corrugated fibreboard liners having Mullen or Cady test equal to or exceeding that of the box, except liner is not required for full depth telescope style box which may be closed as specified by subparagraph (a)(2) of paragraph 17, specification 12B. Not more than 5,000 primers shall be packed in each fibreboard box.

(1) Spec. 23H. Fibreboard boxes of full depth telescope style with top section having extended end flaps and bottom section with extended side flaps designed to tuck under and form boxes without glued or stapled joints. Boxes shall have full height inside perimeter liner and top and bottom full area pads of double-wall corrugated fibreboard. Hand-holes oval in shape, not more than 1 inch in width by 4 inches in length and horizontal with top score line, are authorized in ends of boxes. Primers shall be packed in cellular inside packages with partitions separating the layers and columns of the primers as required by the introductory text of this paragraph. Not more than 50,000 primers shall be packed in one outside box.

(d) Percussion caps must be packed in metal or other inside boxes containing not more than 500 caps; the construction of the cap or packing and the kind and quantity of explosives in each must be such that the explosion of a part of the caps in the completed shipping package will not cause the explosion of all the caps.

(e) Small-arms primers and/or percussion caps may be packed with nonexplosive and/or nonflammable articles, or with small arms ammunition as provided in § 73.101(b). Small-arms primers may be included with propellant explosives (solid), division 1.3 in the same outside container as provided in § 73.93(g)(1). The weight of the small-arms primers or percussion caps must not exceed 5 pounds in any such outside containers.

(f) The gross weight of one outside package must not exceed 150 pounds.

§ 73.108 Common fireworks, signal flares, hand signal devices, smoke signals, smoke candles, smoke grenates, smokepots, and Very signal cartridges. (a) Division 1.4 explosives covered by this section must, unless otherwise specifically provided for, be securely packed in packages complying with the following specifications:

(1) Spec. 11B. Strong, tight, sparkproof wooden barrels.

(2) Spec. 15A, 15B, 16A, or 19A. Wooden boxes. Gross weight not to exceed 100 pounds, except gross weight of 500 pounds is authorized for Very signal cartridges only.

(3) Spec. 12B. Fibreboard boxes. Gross weight not to exceed 65 pounds.

(4) Firecrackers, Chinese, in addition to containers specified in paragraph (a)(1), (2), and (3) of this section, may also be transported in the package in which they are imported, provided these packages consist of wooden boxes, or fibreboard boxes, spec. 12B, in good condition, completely covered with strong matting and do not weigh more than 100 pounds, gross.

(5) Fireworks, such as sparklers, with match tip or head, or similar ignition point or surface, must have each individual tip, head, or similar ignition point or surface entirely covered and securely protected against accidental contact or friction.

(6) Signal flares may be packed with nonexplosive or nonflammable articles provided the outside packages are marked as prescribed in this section.

(b) (Cancelled).

(c) Except as otherwise specified herein the gross weight of one outside package containing common fireworks must not exceed 100 pounds.

§73.109 Toy caps. (a) Toy caps must be packed in containers complying with the following specifications:

(1) Spec. 15A, 15B, 16A, or 19A. Wooden boxes. Gross weight not to exceed 150 pounds.

(2) Spec. 12B. Fibreboard boxes. Gross weight not to exceed 65 pounds.

(3) Toy caps, in addition to containers specified in subparagraphs (a)(1) and (2) of this section, may be transported in the package in which they are imported, provided the package consists of a wooden box, metal-lined, in good condition, and weighing not over 100 pounds gross.

(b) Toy caps may be packed with nonexplosive or nonflammable articles.

(c) Toy paper caps of any kind must not be packed with fireworks.

§ 73.112 Oil well cartridges. (a) Oil well cartridges must be so packed that the explosive composition does not exceed 20 grains per cubic inch of space in the outside shipping containers and must be in specification containers as follows:

(1) Spec. 15A, 15B, 16A, or 19A. Wooden boxes. Gross weight not to exceed 150 pounds.

(2) Spec. 12B. Fibreboard boxes. Gross weight not to exceed 65 pounds.

§ 73.113 Detonating fuzes, division 1.4 explosives. (a) Detonating fuzes, division 1.4 explosives, shall be packed in specification containers as follows:

(1) Spec. 12H. Fibreboard boxes without liners, with well secured inside pasteboard cartons.

(2) In addition to specification containers prescribed in this section, detonating fuzes, division 1.4 explosive, may be packed in well secured, strong, tight outside wooden or metal boxes. The gross weight of the outside wooden or metal box shall not exceed 190 pounds.

§ 73.114 Actuating cartridges, explosive, fire extinguisher or valve. (a) Actuating cartridges, explosive fire extinguisher or valve must be packed in strong wooden or fibreboard boxes.

(c) When shipped as components with fire extinguisher or with valve and with not more than 2 cartridges for each extinguisher or valve, they are exempt from these Regulations.

SUBPART C — FLAMMABLE LIQUIDS

§ 73.116 Outage. (a) Outage for containers offered for transportation by carriers by rail freight or rail express, except as otherwise specifically provided in this part, must be as prescribed in paragraphs (b) to (h) of this section.

(b) Containers shall not be entirely filled. Sufficient interior space shall be left vacant to prevent leakage or distortion of containers due to the expansion of the contents from increase of temperature during transit. This outage shall be calculated for the total capacity of the container. For containers of a capacity of 500L (110 gallons) or less, sufficient outage shall be provided so that the container will not be liquid full at 55°C (130°F).

(d) Flammable liquids must not be loaded into domes of tank cars. If the dome of the tank car does not provide sufficient outage, then vacant space must be left in the shell to make up the required outage.

(f) Flammable liquids for which minimum outage is not otherwise specifically provided in this section shall be loaded in tank cars so that the minimum outage will be the greatest of the following values:

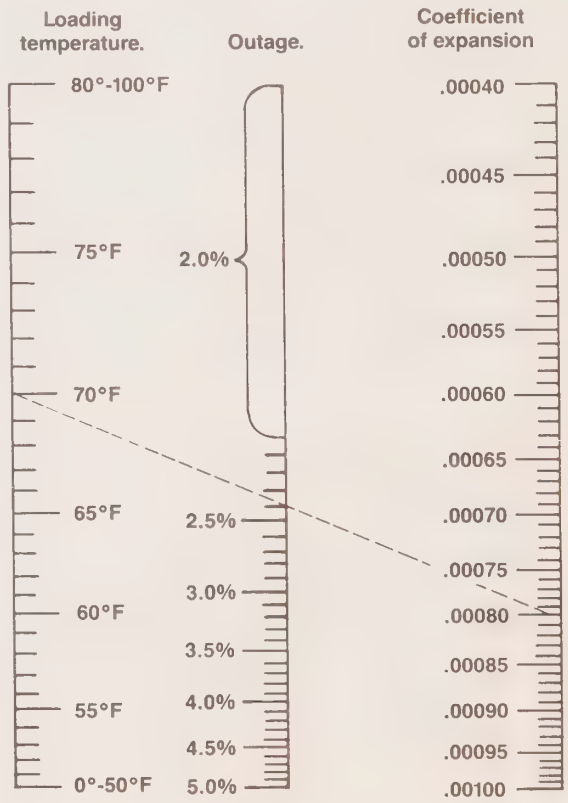
(1) dome capacity,

(2) two per cent of the total capacity of the tank and the dome, or

(3) the outage shown in subsection 73.116(g).

(g) Outage chart for flammable liquids loaded in uninsulated tank cars:

Example: Suppose the temperature of the liquid at time of loading is 70°F. and its coefficient of expansion is 0.00080; lay a ruler on the chart running from 70° to 0.00080 as shown by the dotted line and the required outage is 2.4 per cent where the ruler crosses the outage scale.



The following coefficients of expansion per degree Fahrenheit, of the principal flammable liquids shall be used in determining outages:

Acetone	0.00085
Amly acetate	.00068
Benzol (benzene)	.00071
Carbon bisulphide	.00070
Ether	.00098
Ethyl acetate	.00079
Ethyl (grain) alcohol	.00062
Methyl (wood) alcohol	.00072
Toluol (toluene)	.00063
Gasoline or naphtha:	
50-55°A.P.I.[1]	.00055
55.1-60°A.P.I.	.00060
60.1-65°A.P.I.	.00065
65.1-70°A.P.I.[1]	.00070
70.1-75°A.P.I.[1]	.00075
75.1-80°A.P.I.	.00080
80.1-85°A.P.I.	.00085
85.1-90°A.P.I.[1]	.00090

[1] A.P.I. (American Petroleum Institute), according to the following formula:

$$°\text{A.P.I.} = \frac{141.5}{\text{specify gravity}} - 131.5$$

§ 73.117 Closing and cushioning. (a) All containers must be tightly and securely closed. Inside containers must be cushioned as prescribed, or in any case when necessary to prevent breakage or leakage.

§ 73.118 Exemptions for flammable liquids, division 3.1 and 3.2. (a) Flammable liquids, except those for which no exemptions are provided as indicated by the "No exemption" statement in section 72.5 are, unless otherwise provided, exempt from packaging requirements when packed in accordance with one of the following:

(1) In metal containers not over 1 quart capacity each, packed in strong outside containers, or

(2) In containers having a capacity not over 1 pint or 20 ounces by weight each, packed in strong outside container.

(b) Samples of flammable liquids for laboratory testing, except those marked "No Exemption" in 72.5, may be shipped or stored in express cars or stored in stations, (including those with lighted heaters or where open flame lights or stoves or electric devices having exposed heating coils are used), providing the sample is contained in a container which meets the following requirements:

(1) Capacity of the container must not exceed 1 gallon.

(2) Container must be leakproof when submerged in water and subjected to an air pressure of 5 pounds per square inch. Every container must be so tested. The closure must be secure against leakage when the container, filled with sample liquid, is inverted. If gaskets are used, they must be impervious to the contents. All containers must be retested annually for leakage by submerging in water and subjecting to an air pressure of 5 pounds per square inch.

(3) The container must have a corrosion resistance to the contents and to the atmosphere equivalent to twice the anticipated useful life of the container.

(4) Pillow or bag type containers are not authorized.

(5) The filled container must withstand 2 drops on the rim or edge from a height of 4 feet onto concrete without leaking. A minimum of two containers selected at random from each new production run must be drop-tested. If one or more container fail to pass the test, the entire run must be rejected. The purpose of this test is to determine the adequacy of the container design. Periodic retesting during use is not required A new production run is one in which a new lot of materials is used or in which the method of fabrication or the size or shape of the container differs from the previous run.

(6) Drop testing of the container, as outlined above in (5), will be waived, providing the containers are enclosed in a wooden box, specification 15A, 15B, 15C, 16A or 19A, and the complete package will withstand 2 drops on the same corner from a height of 4 feet onto concrete without leakage from the inside filled container. This test must be done for each new production run of inside containers. Notwithstanding any other requirements which may be to the contrary, inside containers of plastic, rubber, sheet metal of thickness less than No. 24 U.S. standard gauge, or similar materials which are subject to puncture damage, must be enclosed in a wooden box, specification 15A, 15B, 15C, 16A or 19A.

(7) Not more than 3 gallons of sample, contained in inside containers as specified above, may be packed in one outside wooden box.

(9) Outage shall be as prescribed in § 73.116.

§ 73.118a Exceptions for flammable liquids, division 3.3. (a) Unless otherwise ordered by the Committee, flammable liquids, division 3.3 in a packaging having a rated capacity of 500L or less are exempt from packaging requirements of these regulations.

(b) Flammable liquids, division 3.3 in a packaging having a rated capacity of more than 500L, contained in portable tanks or in tank cars are exempt from packaging requirements of these regulations.

§ 73.119 Flammable liquids not specifically provided for. (a) Flammable liquids with flash point 20°F. or below. Flammable liquids with flash point 20°F. or below and having vapor pressure (Reid test) not over 16 pounds per square inch, absolute, at 100°F., other than those for which special requirements are prescribed in this part, must be prepared for shipment in specification containers of a design and constructed of materials that will not react dangerously with or be decomposed by the chemical packed therein, as follows (see paragraphs (c) to (i) of this section for high pressure liquids, paragraphs (j) to (l) of this section for viscous liquids, and paragraph (m) of this section for flammable liquids which are also oxidizing materials or corrosive liquids, and § 73.134 for flammable liquids that are also pyroforic liquids):

(1) Spec. 1A, or 1D. Carboys, glass, boxed or in barrels or kegs, capacity not over 5 gallons, except capacity not over 5½ gallons authorized for spec. 1D. Must be closed, and when reused must be reconditioned and tested, as provided in the specification.

(2) Spec. 5, 5A, 5B, 5C, or 5M. Metal barrels or drums, with openings not exceeding 2.3 inches in diameter.

(3) Spec. 17E. Metal drums (single-trip) with openings not over 2.3 inches in diameter. Drums with a marked capacity of more than 5 gallons but not more than 25 gallons must be constructed of 19-gauge body and head sheets. Drums with a marked capacity in excess of 25 gallons must be constructed of 18-gauge body and head sheets. Drums with a marked capacity of more than 5 gallons are not authorized by rail express.

(4) Spec. 17C. Metal drums (single-trip), with openings not exceeding 2.3 inches in diameter.

(6) Spec. 11A or 11B. Wooden barrels or kegs with inside containers which must be glass or earthenware, not over 1 gallon

each; metal pails, kits, or cans, not over 2 gallons each.

(7) Spec. 12B. Fibreboard boxes with inside containers which must be glass or earthenware, not over 1 quart each; metal cans, not over 1 gallon each.

NOTE 1: Spec. 12B fibreboard boxes with one inside rectangular metal can, spec. 2F not to exceed 5 gallons capacity, are authorized for gasoline only. Gross weight of completed package nor over 65 pounds

(8) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes with inside containers which must be metal pails, kits, or cans, not over 8½ gallons each or inside glass or earthenware containers not over 1 gallon each, except that glass or earthenware containers up to 3 gallons each are authorized when only one inside container is packed in each outside container.

(9) Spec. 21C, 22A or 22B. Fibre drums and plywood drums with a single inside glass, earthenware, or metal container of not over one gallon capacity in each drum. Inside container must be so cushioned at top, sides, and bottom, as to prevent breakage or leakage in transit.

(10) Spec. 42B, 42C or 42H. Aluminum barrels or drums.

(11) Cylinders as prescribed for any compressed gas, except acetylene.

(12) Spec. 103, 103W, 103ALW, 103DW, 104[2], 104W, 105A100[2] 105A100ALW, 105A100W, 106A500X, 106A800XNC, 106A800NCI[2], 109A100ALW, 110A500W, 111A60ALW1, 111A60F1, 111A60W1, 111A100W3, 111A100W4, 111A100W6, 112A200W, 112A400F, 114A340W, 115A60W1, 115A60ALW, 115A60W6, ARA-III[2], ARA-IV[2], or ARA-IVA[2] (see §§ 79.100, 79.101, 79.200, 79.201, 79.220, 79.300, 79.301) tank cars. For cars equipped with expansion domes, manway closures must be so designed that pressure will be released automatically by starting the operation of removing the manway cover. Openings in tank heads to facilitate application of linings are authorized and must be closed in an approved manner.

(14) Spec. 15X. Wooden boxes with inside metal containers are authorized to be transported to ship side by rail freight in carload lots only.

(16) (Cancelled).

(19) Spec. 5L. Metal barrels or drums for gasoline shipments offered by or consigned to the Department of National Defence for Canada or Allies. Use of this container will be permitted until further order of the Commission.

(20) Spec. 12D. Fibreboard boxes with inside containers which must be glass or earthenware not over one gallon each; authorized for not more than 75 pounds gross weight; not to contain more than 4 such inside containers if their capacity is greater than 5 pints each. Use of this container will be permitted until further order of the Commission.

(22) Spec. 17H or 37A. Metal drums with inside glass containers not over 9 pints capacity each. Inside containers may contain biological materials.

(23) Spec. 12A. Fibreboard box with inside glass bottles or spec. 2E polyethylene bottles, not over 1 gallon capacity each. Polyethylene bottles are authorized only for materials that will not react with them, or cause their decomposition. Not more than four inside bottles exceeding 5 pints capacity each may be packed in a package. Shipper must have established that the completed package meets the test requirements prescribed by paragraph 10 of specification 12A.

(24) Spec. 6D. Cylindrical steel overpack with inside spec. 2S polyethylene container.

(25) Spec 51. Portable tanks.

(27) Spec. 12P. Fibreboard box with one inside spec. 2U polyethylene container of not over 5-gallon capacity, or two inside spec. 2U polyethylene containers of not over 2½ gallon capacity each. Authorized only for material which will not react with or cause decomposition of polyethylene.

(28) Spec. 12A. Fibreboard boxes with inside metal containers not over 1-gallon capacity each. Not more than six metal containers shall be packed in a 275-pound test, double faced, corrugated fibreboard, spec. 12A box and gross weight shall not exceed 45 pounds. The inner flap gaps of the box shall not exceed 5/8-inch and the box shall provide a tight fit so there is no movement of the cans within the box.

(b) Flammable liquids with flash point above 20°F. to 80°F. Flammable liquids with flash point above 20°F to 80°F. and having vapor pressure (Reid[1] test) not over 16 pounds per square inch, absolute, at 100°F. other than those for which special requirements are prescribed in this part, shall be prepared for shipment in specification containers of a design and constructed of materials that will not react dangerously with or be decomposed by the chemical packed therein, as follows (see paragraph (c) to (i) of this section for high pressure liquids and paragraph (m) of this section for flammable liquids which are also oxidizing materials or corrosive liquids):

(1) Containers as specified in paragraph (a) of this section, except that openings greater than 2.3 inches in diameter in barrels and drums are authorized when permitted by the specification, and also the following:

(2) Spec. 17E or 17H. Metal drums (single-trip). See § 73.28(m).

(3) Spec. 10B. Wooden barrels or kegs.

NOTE 1: Until further order of the Commission, wooden whiskey barrels, properly recoopered, which comply with all the provisions of spec. 10B, are also authorized. Marking is required on the head of each container, by the reconditioner, by hot branding or legible stencilling, as follows:

CTC-10B
Name or symbol (letters) of reconditioner: this must be registered with the Secretary, Railway Transport Committee and located just above, below, or following the mark CTC-10B.
Size of marking (minimum) 3/4 inch high.

(4) Spec. 12B. Fibreboard boxes with inside containers which must be glass, earthenware, polyethylene (bags are not authorized), or metal, not over 1 gallon each. Packages containing inside glass or earthenware containers must not contain more than 4 such inside containers if their capacity is greater than 5 pints each. Polyethylene containers are authorized only for materials that will not react with or cause decomposition of the plastic.

NOTE 1: Until further order of the Commission, fibreboard boxes, spec. 12B, (26)(a), with one inside rectangular metal can, spec. 2F, not to exceed 4 gallons capacity, are authorized. Gross weight of completed package not over 65 pounds.

(5) Spec. 12E. Fibreboard box with 1 or 2 rectangular metal inside containers of not over 5 gallons capacity each.

(7) Spec. 37P. Steel drums with polyethylene liner (non-reusable container). Authorized only for materials that will not react with polyethylene and result in container failure.

(8) Specification 6D or 37M (non-reusable container). Cylindrical steel over-pack with an inside specification 2S or 2SL polyethylene container. Authorized only for materials that will not react with polyethylene and result in container failure.

(9) Spec. 21P. Fibre drum overpack with inside spec. 2S or 2SL polyethylene container. Authorized only for materials that will not react with polyethylene and result in container failure.

[1] ASTM Test D323.

[2] The use of existing tank cars authorized, but new construction not authorized.

(10) Spec. 37D. Non-reusable steel drum authorized only for a commodity not exceeding 10 pounds per gallon. For a material weighing more than 10 pounds per gallon but not exceeding a weight of 12 pounds per gallon, drum made of not less than 21-gauge body and 20-gauge heads must be used.

(11) Spec. 34. Polyethylene drum. The shipper shall assure conformance with the requirements of section 73.24(e) prior to first shipment.

(c) Flammable liquids for which other special packing requirements are not prescribed. Flammable liquids for which other special packing requirements are not prescribed in this part, must be shipped, depending upon their Reid[2] vapor pressures as prescribed in paragraphs (d) to (i) of this section.

(d) When the vapor pressure does not exceed 16 pounds per square inch, absolute, at 100°F. Containers as prescribed in paragraphs (a) and (b) of this section must be used.

(e) When the vapor pressure exceeds 16 pounds per square inch, absolute, at 100°F. When the vapor pressure exceeds 16 pounds per square inch, absolute, at 100°F., but does not exceed 27 pounds per square inch, absolute, at 100°F. flammable liquids must be packed in specification containers as follows:

(1) As prescribed in paragraph (a)(1) to (11) of this section, except spec. 17E. Bung labels required, for metal barrels and drums, as prescribed in paragraph (i) of this section.

(2) Specification 103[1], 103W, 103ALW, 103DW, 104[1], 104W, 105A100[1], 105A100ALW, 105A100W, 106A500X, 106A800XNC, 106A800NCI[1], 109A100ALW, 109A300W, 110A500W, 111A60ALW1, 111A60F1, 111A60W1, 111A100W3, 111A100W4, 111A100W6, 112A200W, 112A400F, 114A340W, 115A60W1, 115A60W6, 115A60ALW, ARA-III[1], ARA-IV[1], or ARA-IV-A[1] (§§ 79.100, 79.101, 79.200, 79.201, 79.300, 79.301 of this chapter): tank car. A car having an expansion dome must be equipped with a manway closure, identification marks, and dome placards as prescribed in paragraphs (f)(4), (g), (h), and (h)(1) of this section. Opening in tank heads to facilitate application of lining are authorized and must be closed in an approved manner (see §§ 79.3, 79.4 of this chapter) (see Note 1 of paragraph (f)(3) of this section).

(4) Spec. 51. Portable tanks.

(f) When the vapor pressure exceeds 27 pounds per square inch, absolute, at 100°F. When the vapor pressure exceeds 27 pounds per square inch, absolute, at 100°F., but does not exceed 40 pounds per square inch (see Note 2), absolute, at 100°F., flammable liquids must be packed in specification containers as follows:

(1) Spec. 5, 5A, or 5P. Metal barrels or drums, with openings not exceeding 2.3 inches in diameter. Bung labels required as prescribed in paragraph (i) of this section.

(2) Cylinders as prescribed for any compressed gas except acetylene.

(3) Specification 105A100[1], 105A100ALW, 105A100W, 106A500X, 106A800XNC, 106A800NCI[1], 109A100ALW, 109A300W, 110A500W, 111A100W4, 112A200W, 112A400F, 114A340W, ARA-IV-A[1] (§§ 79.100, 79.101, 79.200, 79.201, 79.300, 79.301 of this chapter) (see Note 1). Tank car. Specification 104[1], 104W, 111A100W3, or ARA-IV (§§ 79.200, 79.201 of this chapter) tank cars are authorized under the conditions prescribed in paragraphs (f)(4), (g), (h) and (h)(1) of this section and Note 3 of this subparagraph. Openings in tank heads to facilitate application of lining are authorized and must be closed in an approved manner (see §§ 79.3 and 79.4 of this chapter). Notes 1, 2, and 3 remain the same.

NOTE 1: Tanks built in compliance with American Railway Association specifications for class IV-A[1] tank cars authorized for use effective October 1, 1925, may be continued in service for the transportation of ethyl chloride and other liquids which do not have a vapour pressure exceeding 28 pounds per square inch, gauge pressure, at 100°F., provided there is stencilled on each side of the tank immediately below the valve protecting housing the words "Liquids having vapour pressure exceeding 28 pounds per square inch at 100°F., must not be loaded into this tank", in letters and figures at least 1 inch high. These tank cars must be retested as prescribed in current spec. 105A100-W except that safety valves must open at pressure not exceeding 35 pounds, and be vapour tight at 28 pounds per square inch.

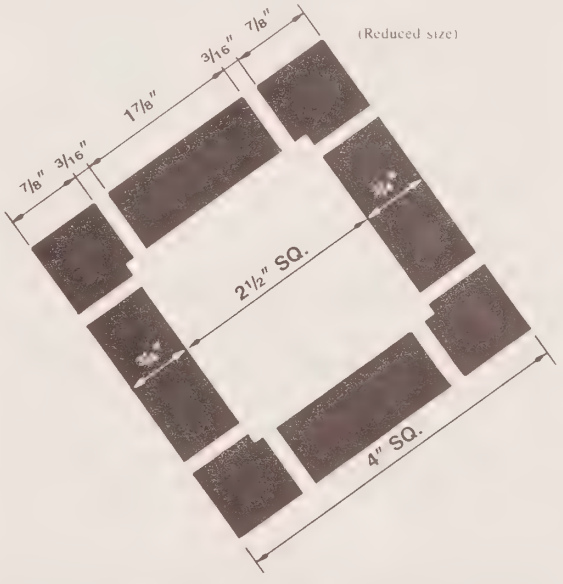
NOTE 2: When the vapor pressure exceeds 40 pounds per square inch, absolute, at 100°F., these flammable liquids are classed as flammable compressed gases and must be described, packed and shipped as prescribed for such commodities.

NOTE 3: Spec. 104[1] or 104-W or ARA-IV[1] tank cars are authorized provided that they are equipped with approved fittings designed to provide for the loading, unloading, gauging, sampling, and taking temperature of the contents without removing the manhole closure; that safety valves are set to open at pressure of 35 pounds (with a tolerance of plus or minus 3 pounds), and are vapour tight at 28 pounds per square inch gauge pressure; that bottom discharge outlets are of the same type as authorized for specification 104[1] or 104-W tank cars; and that there is stencilled on each side of the tank above the specification mark, in letters and figures at least 1 inch high, "For vapour pressures not exceeding 40 pounds per square inch, absolute, at 100°F." Until further order of the Commission, spec. 104[1] or 104-W tank cars, equipped with safety valves set to open at pressure of 35 pounds (with a tolerance of plus or minus 3 pounds) and which are vapour tight at 28 pounds per square inch, gauge pressure, are authorized provided that they are stencilled as required above.

(4) Spec. 103[1], 103-W, 103AL-W, 104[1], 104-W, 111A60ALW1, 111A60-F1, 111A60-W-1, 115A60W1, 115A60W6, 115A60ALW, ARA-III[1], or ARA-IV[1] tank cars. Cars must have their manhole closures equipped with approved safeguards making removal of closures from manhole openings practically impossible while car interior is subjected to vapour pressure of lading. These cars must be stencilled on each side of domes in line with the ladders, and in a colour contrasting to the colour of the dome, with the identification mark as prescribed in paragraph (g) of this section.

(6) Spec. 51. Portable tanks.

(g) Manhole closure identification mark.



(h) Dome placards. Spec. 103[1], 103ALW, 103-W, 104[1], 104-W, 111A60ALW1, 111A60F1, 111A60W1, 115A60W1, 115A60W6, 115A60ALW, ARA-III[1], or ARA-IV[1] tank cars. Cars loaded with materials described in paragraphs (e) and (f) of this section must be protected by special dome placards, at least 4 1/8 by 10 7/8 inches (10.5 cm × 27.6 cm), with legible wording as follows:

[1] Use of existing tank cars authorized, but new construction not authorized.

[2] American Society for Testing Materials—method to test for vapor pressure of petroleum products (D-323)

DOME PLACARD

(Reduced size)

(Black printing on white)

10 ½ inches

4 ½ inches

AVOID ACCIDENTS

DO NOT REMOVE THIS DOME COVER
WHILE GAS PRESSURE EXISTS IN TANK

KEEP LIGHTED LANTERNS AWAY

NOTE 1: For tank cars equipped with both inner and outer manhole covers, and when removal of inner cover is not necessary to unload the car, the word "inner" may be substituted for the word "this" in the dome placard.

(1) Dome placards must be applied one on each side of dome and one on the top near the manhole in line with the ladders. Dome placards may be of white paper securely pasted to the dome, or of strong tag board for use in suitable holders; or the wording of the dome placard may be stencilled on the dome of car and remain thereon as long as it is used in the service which requires these special placards.

(i) Bung label. A flammable liquid as described in paragraph (e) or (f) of this section shipped in a metal drum or barrel shall be labelled near the bung with a white rectangular label or tag measuring 5 by 3 inches (12.7 cm × 7.6 cm) bearing the following wording:

BUNG LABEL

(Reduced Size)

(Black printing on white)

5 inches

3 inches

CAUTION

Unscrew this Bung
SLOWLY

Do not unscrew entirely until all interior pressure has escaped through the loosened threads.

REMOVE BUNG IN OPEN AIR. Keep all open flame lights and fires away. Enclosed Electric Lights are safe.

(j) Viscous flammable liquids. Flammable liquids which have a measured viscosity in excess of 2,500 centistokes at 25°C when determined in accordance with the prescribed test method must be shipped in specification containers as prescribed in paragraph (k) or (l) of this section.

(k) Viscous flammable liquids having a vapor pressure which does not exceed 16 pounds per square inch, absolute, at 100°F. (See paragraphs (c) to (i) of this section for higher pressure liquids) must be prepared for shipment in containers as follows:

(1) As prescribed in paragraphs (a) or (b) of this section, irrespective of flash point.

(2) Spec. 6B or 6C. Metal barrels or drums.

(3) Spec. 37A or 37B. Metal drums (single-trip) not over 5 gallons with welded side seams.

(l) Viscous flammable liquids with flash point above 20°F. to 80°F. and having a vapour pressure which does not exceed 18 pounds per square inch, absolute, at 100°F. must be prepared for shipment in containers as follows:

(1) As prescribed in paragraphs (e) to (i) of this section.

(2) Spec. 17E or 17H. Metal drums (single-trip).

(m) Flammable liquids which are also organic peroxides, oxidizing substances, radioactive materials or corrosives or are poisonous substances packing group II, must be packaged as follows:

(1) Spec. 1A, 1D, or 1EX (single-trip). Glass carboys, boxed or in plywood drums, capacity not over 5 gallons for spec. 1A.

(2) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes with inside containers which must be glass, earthenware or polyethylene not over 1 gallon capacity each. Inside containers must be cushioned with noncombustible packaging material in sufficient quantity to absorb the contents.

(3) Spec. 12B. Fibreboard boxes with inside container which must be glass or earthenware, not over 1 quart each, cushioned with incombustible packing material in sufficient quantity to absorb the contents of the inner container.

(4) Spec. 5, 5A, 5B, 5C, 5P, 17C (single-trip), or 17E (single-trip). Metal barrels or drums. Removable head packagings over 13½ gallons capacity are not authorized. Authorized only for materials which will not react dangerously with the drum metal, or be decomposed by contact with it.

(5) Spec. 37P. Steel dums, not over 15 gallons capacity, with polyethylene liner (nonreusable container). Drums exceeding 1 gallon capacity must be constructed of at least 24 gauge metal. Authorized only for materials that will not react with polyethylene and result in container failure.

(6) Spec. 12B. Fibreboard boxes with inside Specification 2E polyethylene bottles not over 1-gallon capacity each. Not more than four 1-gallon polyethylene bottles shall be packed in one outside fibreboard box. Authorized only for material which will not react dangerously with or be decomposed by contact with polyethylene.

(7) Spec. 12B. Fibreboard boxes with one inside polyethylene bottle not over 5 gallons capacity, as specified by para. 34 of spec. 12B. Authorized only for material which will not react dangerously with or cause decomposition of polyethylene.

(8) Spec. 12P. Fibreboard box with one inside spec. 2U polyethylene container of not over 5-gallon capacity, or two inside spec. 2U polyethylene containers of not over 2 gallon capacity each. Authorized only for material which will not react with or cause decomposition of polyethylene.

(9) Specification steel or nickel cylinders as prescribed for any compressed gas except acetylene. All cylinder valves must be protected by one of the methods described in § 73.301(g)(1), (2), or (3) of this part. See § 73.34(e)(16).

(13) Spec. 103AW, 103ALW, 103A-ALW, 103ANW, 103BW, 103CW, 103DW, 103EW, 103W, 104W, 105A100W, 111A60ALW1, 111A60ALW2, 111A60W1, 111A60W2, 111A60W5, 111A100F2, 111A100W3, 111A100W6, 115A60W6, or AAR206W. Tank cars. All special requirements for tank cars according to flash point, vapour pressure, and viscosity, in paragraphs (a) through (1) of this section apply. Not authorized for flammable liquids which are also organic peroxides.

(14) Spec. 112A200W or 114A340W. Tank cars. Authorized only for propylene oxide except 112A200W also authorized for acrylonitrile and dichlorobutene.

(15) Spec. 51. Portable tank. Authorized only for a flammable

liquid which is also a poisonous substance packing group II. Bottom outlets are not authorized.

(16) Spec. 6D or 37M (non-reusable container). Cylindrical steel overpacks with an inside spec. 2S or 2SL polyethylene container. Authorized only for materials that will not react with polyethylene and result in container failure.

(17) Spec. 6D or 37M (non-reusable container). Cylindrical steel overpacks with an inside spec. 2U polyethylene container, not over 5 gallons capacity. authorized only for materials that will not react with polyethylene and result in container failure.

(19) Spec. 34. Polyethylene drum. Authorized only for flammable liquids which are also organic peroxides or corrosive liquids. The shipper shall assure conformance with the requirements of section 73.24(e) prior to first shipment.

§ 73.120 Automobiles, motorcycles, tractors, or other self-propelled vehicles. (a) Automobiles, motorcycles, tractors, or other self-propelled vehicles equipped with flammable liquid fuel tanks, provided these tanks are securely closed, are not subject to any requirements, except that when offered for transportation by rail express fuel tanks must have been drained and securely closed.

(b) Engines or motors (internal combustion). Engines or motors (internal combustion) employing liquid fuel classed as flammable liquid in this chapter, whether shipped separately or as a part of other apparatus, unless specifically exempt in paragraph (a) of this section, must have their fuel tanks completely drained. Fuel may be left in the carburetor, fuel pump, and fuel lines provided the total flammable fuel content does not exceed 16 ounces and provided the lines are tightly closed to prevent leakage of the fuel.

(c) Truck bodies or trailers on flat cars. Truck bodies or trailers with automatic heating or refrigerating equipments of the flammable liquid type may be shipped with fuel tanks filled and equipment operating or inoperative, when used for the transportation of other freight and loaded on flat cars as part of a joint rail-highway movement, provided the equipment and fuel supply are of a type approved by the Commission. The heating or refrigerating units are exempt from specification packaging requirements in this service and shall be considered as carrier's equipment but not as shipments.

§ 73.121 Carbon bisulphide (disulphide). (a) Carbon bisulphide must be packed in specification containers as follows:

(1) Spec. 11A or 11B. Wooden barrels or kegs with glass, earthenware, or metal inside containers not over 5 pints capacity each.

(2) Spec. 12A or 12B. Fibreboard boxes with inside containers which must be glass or earthenware, not over 1 pint each, or metal cans, not over 1 quart each. Outside containers not to exceed 65 pounds gross weight.

(3) Spec. 15A, 15B, 15C, 16A, or 19A. Wooden boxes with inside metal containers, spec. 2A; or with inside glass or earthenware containers not over 5 pints capacity each.

(4) Spec. 17E. Metal drums (single-trip) not over 5 gallons capacity each, with openings not exceeding 2.3 inches in diameter.

(5) Spec. 5, 5A or 17C (single-trip). Metal barrels or drums not over 46 gallon capacity each, with openings not exceeding 2.3 inches in diameter.

(6) Tank cars as prescribed in § 73.119(a)(12) of this part.

(7) Specification cylinders as prescribed for any compressed gas except acetylene.

(b) Carbon bisulphide (disulphide) must not be offered for transportation by rail express.

§ 73.122 Acrolein, inhibited. (a) Acrolein must be inhibited and when offered for transportation by carriers by rail freight, must be packed in specification containers as follows:

(1) Spec. 5, 5A, or 5B. Metal drums not over 46 gallons capacity each. Spec. 5 or 5B drums must have no opening exceeding 2.3 inches in diameter.

(2) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes with strong inside tight metal containers not over 5 gallons capacity each.

(3) Spec. 105A300W tank cars. Tank cars must be equipped with 150 p.s.i.g. safety relief valves and be stencilled 105A200W.

NOTE 1: (Cancelled).

(4) Spec. 17C. Metal drums (single-trip) with chime reinforcement for bottom head chime seam and having fixed heads, not over 46 gallons capacity. The openings shall be located in one head and shall not exceed 2.3″ in diameter.

(5) Spec. 4B240, 4BA240, or 4BW240 welded cylinders each having a water capacity not exceeding 500 pounds.

(6) Spec. 51 portable tanks each having a water capacity not exceeding 340 gallons.

(b) Acrolein must be inhibited and when offered for transportation by rail express must be packed in specification containers as follows:

(1) Spec. 15A, 15B, 15C, 16A, 19A, or 12B. Wooden or fibreboard boxes having not more than one inside container of glass not exceeding one quart capacity, securely cushioned within a metal container.

§ 73.123 Ethyl chloride. (a) Ethyl chloride must be packed in specification containers as follows:

(1) Spec. 15A, 15B, 15C, 16A, or 19A. Wooden boxes with glass, earthenware, or metal inside containers not over 1 pound capacity each.

(2) Spec. 12B. Fibreboard boxes with glass, earthenware, or metal inside containers not over 1 pound capacity each. Outside containers not to exceed 65 pounds gross weight.

(3) spec. 5A. Metal barrels or drums not over 27½ gallons capacity each.

(4) Cylinders as prescribed for any compressed gas, except acetylene.

(5) Spec. 105A100[1], 105A100-W, 111A100-W-4, 112A200-W, 112A400-F, or ARA-IV-A[1] tank cars. See Note 1 of § 73.119(f)(3).

(7) Spec. 51 portable tanks.

(b) Outage for all containers except tank cars must be 7.5 per cent or more at 70°F. Outage for tank cars must be 4.2 per cent or more at 70°F.

§ 73.124 Ethylene oxide. (a) Ethylene oxide must be packed in specification containers as follows and copper or copper bearing alloys shall not be used in any part of a container, container valve or other container appurtenance if that part is normally in

[1] The use of existing tank cars authorized, but new construction not authorized.

contact with ethylene oxide liquid or vapor.

(1) Spec. 15A, 15B, 15C, or 16A wooden boxes and spec. 12B, fibreboard boxes, with metal inside containers not over 12 ounce capacity each. Each inside container must have a minimum bursting strength of 180 psig as prepared for shipment and be provided with a safety vent having a minimum diameter of 0.1023 inch and closed with fusible metal having a yield temperature of 157 to 170°F. The safety vent opening shall be hot tinned before filling with fusible metal. Filling shall be such that the container will not be liquid full below 185°F. Each inside container must be completely insulated, except for top closure, with two coats of heat-retardant paint, of type approved by the Commission or the Bureau of Explosives, applied over suitable primer and finished with suitable waterproof paint; or with other equally efficient insulation approved by the Commission or the Bureau of Explosives. Not more than 12 inside containers nor more than one layer of containers may be packed in one outside container.

(2) Cylinders as prescribed for any compressed gas, except acetylene, not exceeding 25 gallons water capacity nominal, which meet the following requirements. All cylinders must be seamless or steel welded. Cylinders must be equipped with safety devices of the fusible plug type with threaded straight bore orifice, with yield temperature of 157°F. to 170°F. having a minimum vent area of 0.0055 square inch per pound of water capacity of the container for containers not over 1-gallon capacity and 0.0012 square inch per pound of water capacity of the container for all containers over 1-gallon capacity. Each cylinder must be tested for leakage at a pressure of at least 15 p.s.i. gauge with an inert gas before each refilling. Filling must be such that the container will not be liquid full at 185°F. Pressurizing valves must be provided for all containers over 1-gallon capacity. Eductor tubes must be provided for all containers over 5-gallon capacity. Cylinders having a water capacity in excess of 1 gallon must be insulated with at least three coats of heat-retardant paint, of a type approved by the Commission or the Bureau of Explosives, applied over suitable primer and finished with suitable waterproof paint; or with other equally efficient insulation approved by the Commission or the Bureau of Explosives.

(3) In addition to specification containers prescribed in this section, ethylene oxide may be shipped when packed in strong incombustible outside containers, with inside containers which must be securely sealed glass ampules or vials, contents not over 100 grams each, cushioned in vermiculite or equally efficient incombustible cushioning material. Not more than 100 grams of ethylene oxide shall be packed in any such outside container.

(4) Spec. 5P. Lagged steel drums not over 50 gallons capacity each. Drums must be equipped with safety devices of the fusible plug type with threaded straight bore orifice, with yield temperature of 157 to 170°F. having a minimum vent area of 0.0055 sq. in. per lb. of water capacity of the container for all containers over one gallon capacity. Each drum must be tested for leakage at a pressure of at least 15 p.s.i. gauge with an inert gas before each refilling; top head of each drum must be plainly marked with paint "KEEP THIS END UP." Filling shall be such that the container will not be liquid full below 185°F. and the maximum filling for 50 gallon drums must not exceed 46 gallons of ethylene oxide at 60°F.

(5) Spec. 105A100W or 111A100W4 tank car. Each 105A*** W series tank car must be equipped with a 75 p.s.i.g. safety valve and must be stencilled 105 100W. Outage of each tank must be sufficient to prevent the tank from becoming liquid full at 105°F. Each tank, loaded or empty, must be padded with dry nitrogen or other suitable dry inert gas in sufficient quantity to render the vapor phase in the tank nonflammable at a temperature up to 105°F. Consideration must be given to the lading temperature and the solubility of the gas in ethylene oxide as well as the partial pressure required of the padding gas used to provide this protection. The gas must be free of impurities which may cause the ethylene oxide to rearrange chemically or to polymerize, decompose, or undergo other violent chemical reaction. see §§ 79.102-12 for special requirements for tank cars authorized for ethylene oxide. Openings in tank heads to facilitate application of nickel lining are authorized. These openings must be closed in an approved (§ 79.3) manner, (See Note 1 of § 73.119(f)(3)).

(i) Each specification 105 tank car built after August 31, 1981, used for the transportation of ethylene oxide must conform to CTC specification 105J.

(ii) After December 31, 1987, each specification 105 tank car built before September 1, 1981, having a water capacity (shell full volume, including manways) exceeding 70,000 litres or 18,500 USG and used for the transportation of ethylene oxide, shall conform to CTC specification 105J.

(iii) After December 31, 1987, each specification 111 tank car with a water capacity (shell full volume, including manways) exceeding 70,000 litres or 18,500 USG, used for the transportation of ethylene oxide, shall conform to CTC specification 111J.

(iv) Specification 111 tank cars built after March 1, 1984, are not permitted for the transportation of ethylene oxide.

(v) A 111J specification tank car must comply with the requirements of a 105J tank car as described in sections 79.100-15, 79.100-23 and 79.100-24.

(6) Spec. 51 portable tank. Each tank, loaded or empty, must be padded with dry nitrogen or other suitable dry inert gas in sufficient quantity to render the vapor phase in the tank nonflammable at a temperature up to 105°F. Consideration must be given to the lading temperature and the solubility of the gas in ethylene oxide as well as the partial pressure required of the padding gas used to provide this protection. The gas must be free of impurities which may cause the ethylene oxide to rearrange chemically or to polymerize, decompose, or undergo other violent chemical reaction. Each tank must be constructed to be in compliance with the following requirements.

(i) The tank must be insulated with mineral wool or glass fiber of sufficient thickness so that the thermal conductance at 60°F. is not more than 0.075 B.t.u. per hour, per square foot, per degree Fahrenheit temperature differential. When a tank is equipped with fusible plugs instead of safety relief valve or frangible disc, insulation must also meet the requirement of sub-subparagraph (iii).

(ii) The insulating material of the tank must be protected by a steel jacket having a minimum thickness of 12 gauge. This jacket must be applied to prevent moisture from coming in contact with the insulation.

(iii) Each tank must be equipped with a safety relief valve or frangible disc, meeting the requirements of § 73.315, set to relieve at 75 p.s.i.g. Instead of a safety relief valve or frangible disc, a tank may be equipped with safety devices of the fusible plug type with threaded straight base orifice, with yield temperature of 157° to 170°F., having a minimum vent area of 0.0012 square inch per pound of water capacity of the container. When a fusible plug is used instead of a safety relief valve or frangible disc, the tank must be insulated with mineral wool or glass fiber of such insu-

lating properties and required additional thickness that the tank filled as for shipment will not rupture in a fire.

(iv) Filling must be such that the tank will not be liquid full below 185°F.

(v) Copper, silver, mercury, magnesium, or their alloys may not be used in any part of the tank or appurtenances if that part or appurtenance is normally in contact with ethylene oxide liquid or vapor.

(vi) Neoprene, natural rubber and asbestos gaskets are prohibited. All packings and gaskets must be constructed of materials which do not react spontaneously with or lower the autoignition temperature of ethylene oxide.

(vii) The capacity of the tank may not exceed 250 gallons.

(7) Spec. 34. Polyethylene drum.

§ 73.125 Alcohol. (a) Alcohol must be packed as follows:

(1) In containers as prescribed in § 73.119(a) and (b) of this part.

(2) Securely closed metal tanks not exceeding 13 gallons capacity, made of metal not lighter than 20 gauge, United States standard, packed in strong outside wooden boxes, may be used for the transportation of natural history or laboratory specimens preserved in alcohol, when shipped by or for the Government of Canada.

(3) Spec. 12B. Until further order of the Commission, inside glass containers not over one gallon capacity each are authorized when only one inside container is packed in each outside container.

(4) Until further order of the Commission, existing tank cars complying with spec. 103[1], 103-W, ARA-III[1], AAR 203[1], or AAR 203-W[1], previously used for the transportation of wine, are authorized when stencilled "Alcohol Only" and equipped with safety valves of the type required on spec. 103[1] tank cars.

(5) Spec. 6D. Cylindrical steel overpack with inside spec. 2S polyethylene container.

(6) Spec. 12B. Fibreboard boxes with inside polyethylene bottles, not over 1-gallon capacity each, suitably cushioned to prevent movement within the box.

(7) Spec. 12P. Fibreboard boxes with inside spec. 2U polyethylene containers not over 5 gallons capacity each. Wire staples are not authorized for assembly or closure of boxes, except when polyethylene container is completely enclosed in inside boxes free of wire staples, or other projections, that could cause failures.

§ 73.126 Nickel carbonyl. (a) Nickel carbonyl must be packed in specification cylinders as prescribed for any compressed gas, except acetylene. Cylinders used exclusively for nickel carbonyl may be given a complete external visual inspection at the time periodic retest becomes due in lieu of the interior hydrostatic pressure test required by § 73.34(e). Visual inspection shall be in accordance with CGA Pamphlet C-6.

(b) Nickel carbonyl must not be offered for transportation by rail express.

§ 73.127 Nitrocellulose or collodion cotton, fibrous or nitro-starch wet; nitrocellulose flakes; colloided nitrocellulose, granular, flake, or block, and lacquer base or lacquer chips, wet. (a) Nitrocellulose, fibrous, wet with alcohol or solvent, must contain at least 25 per cent by weight of alcohol or a solvent with flash point not lower than 30°F., collodion cotton, fibrous and nitrostarch, wet with alcohol or a solvent, must contain at least 30 per cent by weight of alcohol or a solvent with flash point not lower than 30°F., nitrocellulose flakes; colloided nitrocellulose, granular or flake; lacquer base or lacquer chips, wet with alcohol or a solvent, must contain at least 20 per cent by weight of alcohol or a solvent with flash point not lower than 30°F., and nitrocellulose blocks wet with alcohol must contain at least 25 per cent by weight of alcohol and must be packed in specification containers as follows:

(1) Containers, except tank cars, as prescribed in § 73.119.

(2) Spec. 6A, 6B, 6C, or 6J. Metal barrels or drums not over 46 gallons capacity. Spec. 6J drums must have removable heads of 14 gauge metal or 16 gauge metal with one or more corrugations near the periphery and heads must have a minimum convexity of 3/8 inch; each drum must have three rolled or swedged-in hoops, one of which shall be in the body near the curl.

(4) Spec. 37A or 37B. Metal barrels or drums.

(5) Spec. 6J. Metal drums. Authorized only for nitrocellulose in solid block forms and wet with alcohol to not less than 25 per cent by weight. Authorized only for carload shipments.

(b) Except for spec. 37A which is limited to 480 pounds, gross weight of any container must not exceed 490 pounds.

§ 73.128 Paints and related materials. (a) Paint, enamel, lacquer, stain, shellac, varnish, aluminum bronze, gold, wood filler, liquid, and lacquer base liquid, and thinning, reducing and removing compounds therefore, and driers, liquid, therefor must be packed in specification containers as follows:

(1) As prescribed in § 73.119 of this part, according to flash point, pressure, or viscosity.

(2) Spec. 37A or 37B. Metal drums (single-trip) not over 5 gallons capacity with welded side seams for drums over 2 gallons capacity, irrespective of flash point or viscosity. Spec. 37A metal drums constructed with 26-gauge body sheets, 24-gauge removable heads, and 26-gauge bottom heads are authorized for not over 80 pounds gross weight.

(3) Spec. 52[1], or 57. Metal portable tank.

(4) Spec. 37C. Metal drums (non-reusable containers) not over 5 gallons capacity each. Authorized only for materials having flash point above 20°F.

(5) Spec. 37D. Nonreusable steel drums. Authorized only for materials not exceeding 12 pounds per gallon and having a flash point above 20°F.

(6) Spec. 34. Polyethylene drum. The shipper shall assure conformance with the requirements of section 73.24(e) prior to first shipment.

(c) Paint, enamel, lacquer, stain, shellac, varnish, liquid wood filler and lacquer base liquid, and thinning, reducing and removing compounds therefor, and driers, liquid, therefor, in glass containers of not over 1 quart capacity each, or metal containers of not over 5 gallons capacity each, packed in strong outside containers are exempt from specification packaging requirements.

§ 73.132 Adhesives containing a flammable liquid and coating solution. (a) Adhesives containing a flammable liquid and coating solution must be packed in specification containers as follows:

(1) As prescribed in § 73.119 irrespective of flash point or vis-

[1] The use of existing tank cars or tanks authorized, but new construction not authorized.

cosity, except that spec. 10B wooden barrels and kegs must not be used.

(2) Spec. 52 or 57. Metal portable tank. Authorized for viscous liquids as described in § 73.119(j).

(3) Spec. 37C. Metal drums (non-reusable container) not over 5 gallons capacity each. Authorized only for materials having flash point above 20°F.

(b) The adhesives and solutions identified in paragraph (a) except any adhesive or solution containing carbon disulphide, in glass or leakproof packagings consisting of a fibreboard body and metal tops and bottoms of not over 1 quart capacity each, or metal packagings of not over 5 gallons capacity each, further overpacked in a strong outside packaging are exempt from specification packaging requirements. When a fibreboard box is used for these shipments by rail freight or rail express, the gross weight must not exceed 65 pounds.

NOTE 1: Until further order of the Commission, rubber cement containing no carbon bisulphide may be shipped in specification 10A, wooden barrels or kegs.

§ 73.133 Nitroglycerin solution. (a) Nitroglycerin or glyceryl trinitrate, in solution not exceeding 1 per cent by weight in alcohol must be packed in specification containers as follows:

(1) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes lined with paraffined paper, Spec. 2L, and with inside metal containers, securely closed with rubber stoppers tied in place. The inside containers must be entirely surrounded by at least 2 inches of dry, fine sawdust or kieselguhr. Not more than 6 quarts of this mixture may be packed in any outside wooden box.

(2) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes with inside glass containers not over 1-quart capacity each, cushioned by at least 2 inches of dry, fine sawdust or kieselguhr.

§ 73.134 Pyroforic liquids, n.o.s. (a) Pyroforic liquids, n.o.s., must be packed in specification packagings as follows:

(1) Specification steel or nickel cylinders prescribed for any compressed gas except acetylene having a minimum design pressure of 175 pounds per square inch are authorized. Cylinders with valves must be:

(i) Equipped with steel valve protection caps or collars, when shipped loose, or

(ii) Overpacked in a strong wooden box; or in a spec. 33A polystyrene case, and secured to protect all valves. Unless packed in a box or case, any safety relief device must be in the vapor space of any loaded cylinder.

(2) Spec. 15A, 15B, 15C, or 19B. Wooden boxes or Spec. 12B fibreboard boxes enclosing not more than four strong tight metal cans with inside containers of glass or metal, not over 1-quart capacity each, having positive screwcap closures adequately gasketed ahead of the threads. Inside containers must be cushioned on all sides with dry, absorbent, noncombustible material in a quantity sufficient to absorb the entire contents. The metal cans must be closed by positive means, not by friction.

(3) Spec. 17C or 37A. Metal drums (single-trip) with inside metal cans not over 1 gallon capacity each, constructed of not less than 28 gauge electro-coated tin plate closed by positive means, not friction. Inside containers shall have no opening exceeding 1 inch diameter and must be surrounded on all sides with incombustible cushioning material. Spec. 17C, 25-gallon capacity drums, shall contain not more than 17 gallons of pyroforic liquids, n.o.s. per drum and 46 gallon capacity drums shall contain not more than 29 gallons of pyroforic liquids, n.o.s. per drum; each layer of inside containers must be separated by a tin plate separator in addition to cushioning material. Spec. 37A drums shall not exceed 5 gallons capacity each.

(4) Spec. 105A300-W tank cars.

(5) Spec. 51. Portable tanks having a minimum design pressure of 175 pounds per square inch. Safety relief devices must communicate with the vapour space when tanks are fully loaded.

(b) Pyroforic liquids, n.o.s., when offered for transportation by rail express must be packaged in containers as prescribed by paragraph (a)(1), (2) or (3) of this section.

§ 73.135 Diethyl Dichlorosilane, Dimethyl Dichlorosilane, Ethyl Dichlorosilane, Ethyl Trichlorosilane, Methyl Trichlorosilane, Trimethylchlorosilane, and vinyltrichlorosilane. (a) Diethyl Dichlorosilane, Dimethyl Dichlorosilane, Ethyl Dichlorosilane, Ethyl Trichlorosilane, Methyl Trichlorosilane, Trimethylchlorosilane, and vinyltrichlorosilane shall be packed in specification containers which comply with one of the following specifications:

(1) Spec. 15A or 16B. Wooden boxes with glass inside containers not over 1 gallon capacity each securely closed and cushioned with incombustible absorbent material.

(2) Spec. 17H or 37A. Metal drums (single-trip) with glass inside containers not over 1 gallon capacity each securely closed and cushioned with incombustible absorbent material.

(3) Spec. 5A. Metal drums not over 46 gallons capacity.

(5) Spec. 5, 5B, 5C, and 17E (single-trip). Metal drums. These containers not authorized for shipments by rail express.

(6) Specification cylinders as prescribed for any compressed gas, except acetylene.

(7) Spec. 103[1], 103-W, 111A60-F-1, or 111A60-W-1 tank cars, without bottom discharge outlet.

(8) Spec. 105A100[1], 105A100-W, or 111A100-W-4, tank cars.

(10) Spec. 51. Portable tanks.

§ 73.136 Methyl dichlorosilane and trichlorosilane. (a) Methyl dichlorosilane and trichlorosilane must be packed in specification container as follows:

(1) Spec. 15A, 15B, 16B or 19B. Wooden boxes with inside glass containers not over 1-quart capacity each, securely closed and cushioned with incombustible absorbent material.

(2) Spec. 17H or 37A. Metal drums (single-trip) with glass inside containers not over 1 quart capacity each securely closed and cushioned with incombustible absorbent material.

(3) Spec. 5A, 5B, or 5C. Metal drums not over 46 gallons capacity each. Spec. 5B drums must have no opening exceeding 2.3 inches in diameter. These containers not authorized for shipment by rail express.

(5) Specification cylinders as prescribed for any compressed gas, except acetylene.

(6) Spec. 103[1], 103-W, 111A60-F-1, or 111A60-W-1. Tank cars, without bottom discharge outlet.

(7) Spec. 105A100[1], 105A100-W, or 111A100-W-4. Tank cars.

(9) Spec. 51. Portable tanks.

§ 73.137 Lithium aluminum hydride, ethereal. (a) Lithium aluminum hydride, ethereal, must be packed in specification

[1] Use of existing tank cars authorized, but new construction not authorized.

containers as follows:

(1) Spec. 15A or 19B. Wooden boxes with inside glass or earthenware containers not over 1 quart each enclosed in air-tight metal cans and cushioned with sufficient incombustible cushioning material to completely absorb contents in event of breakage.

(2) Spec. 6B, 6C, or 17H (single-trip). Metal barrels or drums with not more than one inside glass container not exceeding 2 gallons capacity. The inside container must be completely cushioned in sufficient incombustible cushioning material to completely absorb the contents in event of breakage.

(3) Specification steel or nickel cylinders as prescribed for any compressed gas except acetylene. Valves or fittings must be protected from injury by a metal cap or equally efficient device securely attached to the cylinder.

§ 73.138 Pentaborane. (a) Pentaborane must be packed in specification cylinders as prescribed for any compressed gas, except acetylene. Cylinders must be protected with valve protection cap or must be packed in strong wooden boxes and blocked therein so as to protect the valves from injury under conditions normally incident to transportation. Cylinders not exceeding 2 inches in diameter nor 6 inches in length, excluding the length of the valve, may also be packed in strong solid fibreboard boxes, having no outside dimension less than 4 inches, completely filled with layers of strong corrugated fibreboard, the centre of which shall be cut out to fit the cylinder valve, and otherwise so designed that neither the cylinder not the valve will be in contact with any wall of the box under conditions normally incident to transportation.

(b) Pentaborane must not be offered for transportation by rail express.

§ 73.139 Ethylene imine, inhibited, and propylene imine, inhibited. (a) Ethylene imine and propylene imine must be inhibited and must be packed in specification containers as follows:

(1) Spec. 15A, 15B, or 19B. Wooden boxes, with inside containers which must be securely sealed glass ampules or glass bottles, contents not over 16 fluid ounces or 1 pound each, in tightly closed metal cans. If more than one ampule or bottle is packed in a metal can, ampules or bottles must be separated by fibreboard partitions. Ampules or bottles must be cushioned in vermiculite or equally efficient incombustible cushioning material in quantity sufficient to completely absorb contents in event of breakage. Not more than 5 pints of liquid may be packed in any outside wooden box.

(2) Spec. 15A, 15B, 15C or 19B. Wooden boxes with not more than four inside metal drums, spec. 37B, not over 1-gallon capacity each, or not more than one spec. 37B metal drum of 5-gallons capacity, in one outside box. Inside drums must be surrounded on all sides with incombustible absorbent cushioning material.

(3) Spec. 6B, 6C or 6J. Metal barrels or drums with one inside spec. 17E metal drum not over 25-gallons capacity. Inside drum must be completely surrounded with incombustible cushioning material.

(4) Spec. 104W, 105A100W or 111A60W1. Tank cars, for ethylene imine, inhibited only. Specification 111A60W1 tank cars must be insulated in accordance with § 79.200-4.

(5) Spec. 5A. Metal barrels or drums not over 46-gallon capacity. Authorized for propylene imine, inhibited only.

(6) Spec. 4B240, 4BA240, or 4BW240. Cylinders of all welded construction.

§ 73.140 Zirconium, suspended in a flammable liquid. (a) Zirconium suspended in a flammable liquid must be packed in specification containers as follows:

(1) Spec. 15A, 15B, 15C or 19B. Wooden boxes with inside metal containers. Each inside container shall not contain more than 20 individual glass or porcelain jars, not exceeding 2-ounce capacity each, securely closed and completely cushioned in incombustible cushioning material in sufficient quantity to completely absorb the contents.

§ 73.141 Amyl mercaptan, butyl mercaptan, ethyl mercaptan, mercaptans liquid n.o.s., mercaptan mixtures, liquid, n.o.s. and propanethiols. (a) Amyl mercaptan, butyl mercaptan, ethyl mercaptan, mercaptans liquid, n.o.s., mercaptan mixtures, liquid, n.o.s. and propanethiols must be packed in specification containers as follows:

(1) Spec. 15A, 15B, 15C, 16A, or 19A. Wooden boxes with securely closed inside metal containers not over 5 gallons capacity each; or in tightly closed glass bottles not exceeding 1 quart capacity each, securely cushioned in sufficient quantity of absorbent material to completely absorb the contents in event of leakage.

(2) Spec. 12B. Fibreboard boxes with securely closed inside metal containers not over 1 gallon capacity each; or in tightly closed glass bottles not exceeding 1 quart capacity each, securely cushioned in sufficient quantity of absorbent material to completely absorb the contents in event of leakage.

(3) Spec. 5, 5A, 5B, or 5C. Metal barrels or drums, with not more than one opening not exceeding 2.3 inches in diameter and not more than one vent opening not exceeding 1 inch in diameter. Gaskets are required and must be not less than 3/32 inch thick and of resilient material such as polyethylene, neoprene, or equally efficient material.

(4) Spec. 17C. Metal drums (single-trip), with not more than one opening not exceeding 2.3 inches in diameter and not more than one vent opening not exceeding 1 inch in diameter. Gaskets are required and must be not less than 3/32 inch thick and of resilient material such as polyethylene neoprene or equally efficient material.

(5) Spec. 17E. Metal drums (single-trip), not over 5 gallons capacity, without opening except bung hole not exceeding 2.3 inches in diameter. Gaskets are required and must be not less than 3/32 inch thick and of resilient material such as polyethylene, neoprene, or equally efficient material. (See also paragraph (a)(6) of this section.)

(6) Spec. 17E. Metal drums (single-trip), not over 46 gallons capacity, with not more than one opening not exceeding 2.3 inches in diameter and not more than one vent opening not exceeding 1 inch in diameter. Gaskets are required and must be not less than 3/32 inch thick and of resilient material such as polyethylene, neoprene, or equally efficient material. Authorized only for mercaptans having flash point above 20°F.

(7) Spec. 103W, 105A100, 105A100W, 105A200ALW, 106A500X, 110A500W, 111A60F1, 111A60W1, 112A200W, 112A400F, or 114A340W. Tank cars. Specs. 103W, 111A60F1, 111A60W1, and 114A340W tank cars must not be equipped with any bottom outlet. Bottom washout permitted. Spec. 105A200ALW is authorized for ethyl mercaptan only.

(9) Specification cylinders as prescribed for any compressed

gas, except acetylene.

(10) Spec. 51. Portable tank. Each tank must be equipped with safety relief valves which must be in compliance with all requirements of § 73.315(i). A tank must not be liquid full at 130°F.

(b) Warning or odorizing devices containing not more than one ounce of a mercaptan or an aliphatic mercaptan mixture in a hermetically sealed container or in a hermetically sealed portion of the device are not subject to these regulations.

§ 73.143 Methylchloromethyl ether, anhydrous. (a) Methylchloromethyl ether, anhydrous, must be packed in specification containers as follows:

(1) Spec. 5K. Nickel barrels or drums.

(2) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes with inside containers which must be glass or earthenware, not over 1 gallon capacity each, except that inside containers up to 3 gallons each are authorized when only one inside container is packed in each outside container.

(b) Methylchloromethyl ether, anhydrous, must not be offered for transportation by rail express.

§ 73.144 Inks. (a) Inks must be packed in specification containers as follows:

(1) In containers as prescribed in § 73.119, according to flash point, pressure, or viscosity.

(2) Spec. 17C. Full removable head metal drums (single-trip).

(3) Spec. 37C. Metal drums (non-reusable container) not over 5 gallons capacity each. Authorized only for material having flash point over 20°F.

(b) Ink in glass packagings not over 1 quart capacity each, or in metal packagings not over 5 gallons capacity each, further overpacked in a strong outside packaging is excepted from the specification packaging requirements of this part. When a fibreboard box is used for these shipments, the gross weight must not exceed 65 pounds.

§ 73.145 Dimethylhydrazine, unsymmetrical, and methylhydrazine. (a) Dimethylhydrazine, unsymmetrical, and methylhydrazine must be packed in specification containers as follows:

(1) Spec. 1D. Boxed glass carboys.

(2) Spec. 15A, 15B, 15C or 19B. Wooden boxes with inside containers which must consist of glass bottles not exceeding 1-gallon capacity each, cushioned by means of vermiculite within tin cans which shall be tightly closed, or containers not over 2 quarts capacity each made of aluminum not less than 0.04 inch thick. Closures and gaskets must be of material which will not react dangerously with or be decomposed by contact with the contents.

(3) Spec. 5, 5A, or 5C; or 17E (single-trip). Metal barrels or drums which shall be of type 304 or 347 stainless steel, with openings not exceeding 2.3 inches in diameter.

(4) Spec. 17C. Metal barrels or drums (single-trip) with opening not exceeding 2.3 inches in diameter. Authorized only for dimethylhydrazine, unsymmetrical.

(5) Spec. 42B. Aluminium drums. Authorized only for dimethylhydrazine, unsymmetrical.

(6) Spec. 103W, 103CW, 105A100W, 111A60W1, 111A60W7, or 111A100W4. Tank cars. Authorized for dimethylhydrazine, unsymmetrical only. Each tank car shall be equipped with steel safety valves of approved design and any 103W or 111A tank car shall not be equipped with any bottom outlet. Bottom washout permitted. Spec. 105A200W, 105A300W, 105A400W, 105A500W, and 105A600W tanks shall be restenciled 105A100W and be equipped with safety valves of the type and size used on spec. 105A100W tank cars.

§ 73.147 Methyl vinyl ketone, inhibited. (a) Methyl vinyl ketone must be inhibited and must be packed in specification containers as follows:

(1) As prescribed in § 73.119(a) or (b).

(b) Methyl vinyl ketone, inhibited, in glass or metal inside containers having not over 4 fluid ounces each and not more than one inside container securely and efficiently cushioned in strong outside fibreboard or wooden boxes, is exempt from specification packaging requirements.

§ 73.148 Monoethylamine. (a) Monoethylamine must be packed in specification containers as follows:

(1) Spec. 5, 5A or 5P. Metal barrels or drums, with openings not exceeding 2.3 inches in diameter. Bung labels required as prescribed in § 73.119(i).

(2) Cylinders as prescribed for any compressed gas except acetylene.

(3) Tank cars prescribed in § 73.119(f)(3).

(4) Spec. 106A500X or 110A500W tanks. Authorized for transportation by rail freight. (See § 74.560 for special requirements.)

(6) Spec. 51. Portable tanks. Tanks must have no bottom opening, except one 3-inch maximum plugged opening for maintenance purposes.

(b) Solution of monoethylamine in water which has a vapor pressure not exceeding 16 pounds per square inch absolute at 100°F. may be shipped in containers prescribed by § 73.119(d).

§ 73.149 Methyl magnesium bromide in ethyl ether in concentrations not over 40 per cent. (a) Methyl magnesium bromide in ethyl ether in concentrations not over 40 per cent must be packed in specification containers as follows:

(1) As prescribed in § 73.134 paragraphs (a) and (b).

(2) Spec. 12B. Fibreboard boxes with inside glass bottles not over 1 quart capacity each. Inside containers must be surrounded on all sides with dry absorbent non-combustible material in quantity sufficient to absorb entire contents. Authorized gross weight not over 65 pounds.

(3) Spec. 17C. Metal drums (single-trip) with openings not exceeding 2.3 inches in diameter.

§ 73.149a Nitromethane. Nitromethane shall be packaged as specified in subsection 73.119(b) except that shipment of nitromethane in cargo tanks, tank cars, portable tanks, and any container having a capacity greater than 500 litres is forbidden.

SUBPART D—FLAMMABLE SOLIDS AND OXIDIZING SUBSTANCES

§ 73.152 Packing. (a) Commodities included in class 4 or oxidizing substances must not be packed in the same outside container with corrosive liquids unless the corrosive liquids are in bottles, cushioned by incombustible absorbent material, in tightly closed metal containers.

NOTE 1: Oxidizing or other substances in quantity not exceeding 4 ounces in securely closed metal cans, packed in the same compartment with other securely packed materials necessary for a complete fumigant, are acceptable for transportation.

(b) Closing and cushioning. All containers must be tightly and securely closed. Inside containers must be cushioned as prescribed or in any case when necessary to prevent breakage or leakage.

§ 73.153 Exemptions for Commodities included in class 4 and oxidizing substances. (a) Commodities included in class 4 and oxidizing substances except those for which no exemptions are provided as indicated by the "No exemption" statement in § 72.5, in inside containers not over 1 pound net weight each, in outside containers not exceeding 25 pounds net weight each are, unless otherwise provided, exempt from specification packaging requirements. (See § 73.182 for exemptions for nitrates, and paragraph (b) of this section for exemptions for organic peroxides).

(b) Liquid or solid oxidizing substances or organic peroxides are, unless otherwise provided, exempt from specification packaging requirements when packed in accordance with the following subparagraphs.

(1) Oxidizing substances in inside containers having a rated capacity of not over one pint for liquids or a net weight of not over one pound for solids, in strong outside packagings not exceeding 25 pounds net weight each.

(2) Organic peroxides, except acetyl benzoyl peroxide and benzoyl peroxide, as follows:

(i) In inside containers which must be securely packed and cushioned with noncombustible cushioning material (except that cushioning material is not required when the liquid is contained in strong, securely closed plastic packagings of not over 1 ounce by volume capacity each), further overpacked in strong outside packagings containing not over 1 pint or 1 pound net weight of the material.

(ii) In not more than 24 inside fiberboard containers each having not more than 70 securely closed tubes having a maximum fluid capacity each of 1/6-ounce and securely packed in non-combustible cushioning material.

§ 73.154 Commodities included in class 4, organic peroxide solids and oxidizing substances not specifically provided for. (a) Solid substances included in class 4, organic peroxide solids and oxidizing substances, other than those for which special packing requirements are prescribed, must be packed in specification containers of a design and constructed of materials that will not react dangerously with or be decomposed by the chemical packed therein, as follows:

(1) Spec. 6B or 6C. Metal barrels or drums.

(2) Spec. 17C, 17E, 17H, 37A, or 37B, metal drums (single-trip).

(3) Spec. 57. Portable tanks. Tanks must have a fusible plug having a fusing temperature between 70°C and 90°C. Authorized only for dicumyl peroxide, dry and a'-bis(t-butylperoxy) diisopropyl-benzene, solid.

(5) Spec. 56. Metal portable tanks. Authorized only for commodities included in class 4 and dry oxidizing substances.

(6) Spec. 12B. Fibreboard boxes with inside containers which must be metal cans; sliding-lid wooden boxes; fibre cans or boxes, spec. 2G, not over 5 pounds capacity each; or glass bottles not over 1 pound capacity each. Packages containing glass containers must not weigh over 65 pounds gross.

(7) Spec. 15A or 15B. Wooden boxes lined, spec 2F or 2M.

(8) spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes with inside containers.

(9) Spec. 21C. Fibre drums. Maximum net weight may not exceed 225 pounds except that a 21C400 fibre drum may have a net weight not exceeding 350 pounds.

(10) Spec. 22A. Plywood drums.

(11) Spec. 22B. Plywood drums with inside metal drums, spec. 2F.

(12) Spec. 12B. Fibreboard boxes constructed of at least 275-pound test double-faced fibreboard and provided with a perimeter liner and bottom pad of at least 200-pound test fibreboard. Boxes constructed of at least 350-pound fibreboard having top and bottom pads shall not require perimeter liner. Product must be contained within a tightly closed polyethylene or other equally efficient plastic bag constructed of material having minimum thickness of 0.004 inch. Not more than 25 pounds net weight of product may be packed in one outside box.

(13) Spec. 12A. Fibreboard boxes with inside glass bottles not over 5 pounds capacity each. Not more than four bottles having capacity of 5 pounds each, shall be packed in one outside container. Shipper must have established that completed package meets test requirements prescribed by Paragraph 10 of Spec. 12A.

(14) Spec. 12B. Fibreboard boxes with inside polyethylene bottles not over 1-gallon capacity each or polyethylene jars not over 9 pints capacity each. Each jar shall contain not more than 10 pounds net weight of product. Not more than four bottles or jars may be packed in one outside container. Authorized only for materials which will not cause decomposition of polyethylene or container failure.

(15) Spec. 103[1], 111A60WA, or 111A60F1. Tank cars. Authorized only for sodium perchlorate or magnesium perchlorate wet with 10 percent or more water equally distributed.

(16) Spec. 35 non-reusable, removable head polyethylene drum for use without overpack and not over six gallons capacity. Authorized only for dry or paste material that will maintain its form to a minimum temperature of 130°F.

(17) Spec. 103ALW or 111A60ALW. Insulated tank cars designed for operation at temperatures up to 250°F. Authorized only for ammonium nitrate with 15 percent or more water in solution at a maximum temperature of 240°F.

(19) Spec. 6D or 37M. Cylindrical steel overpacks (non-reusable containers) with inside spec. 2S, 2SL, or 2U polyethylene packaging.

(21) Spec. 105A200ALW. Tank cars. Authorized only for a mixture of 24 to 26 percent ammonia, 68 to 70 percent ammonium nitrate and 5 to 7 percent water.

(22) Spec. 44P. All plastic bags. Authorized only for ammonium persulphate, potassium persulphate, sodium carbonate peroxide, sodium perborate monohydrate and sodium persulphate. Net weight may not exceed 81 pounds.

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[1] Use of existing tank cars authorized, but new construction not authorized.

(23) Spec. 44B or 44C. Multiwall paper bags. Authorized only for ammonium persulphate, lead phosphite dibasic, potassium persulphate, sodium carbonate peroxide, sodium perborate monohydrate and sodium persulphate.

§ 73.154a Fusees. (a) A fusee is a device designed to burn at a controlled rate and to produce visible effects for signalling purposes. It consists of a pasteboard of fibre tube containing a coloured flare mixture and with or without a means of support. The composition of the fusee must be such that spontaneous ignition does not occur when the moistened composition is exposed to a temperature of 212°F. for 72 consecutive hours. Fusees must have individual tip, head, or similar ignition point or surface entirely covered and securely protected against accidental contact or friction. Fusees must be securely packed in packages complying with the following specifications:

(1) Spec. 15A, 15B, 15C, 16A, 19A or 19B. Wooden boxes having a gross weight not to exceed 150 pounds for spec. 19B boxes, 200 pounds for the other boxes. When spec. 15C boxes are used, devices must be packed in air-tight inside metal receptacles.

(2) Spec. 12B. Fibreboard boxes. Boxes must have reinforced ends proven to be capable of preventing penetration of spikes through the outside box when a sample package, prepared as for shipment, is subjected to two drops from a height of 4 feet onto a solid surface. The package must be dropped so as to strike diagonally with the spikes in a downward position. Gross weight not to exceed 65 pounds except that gross weight not to exceed 75 pounds is authorized in boxes made in accordance with paragraph 24 of spec. 12B.

(3) Spec. 29. Mailing tubes, provided the penetration of the spikes of the fusees through the outside container is prevented by the method specified for fibreboard boxes, spec. 12B, in subparagraph (2) of this paragraph. Gross weight not to exceed 5 pounds.

(4)Fusees without spikes when offered for shipment may be packed in packages prescribed in this paragraph, omitting the protection required for these devices when equipped with spikes.

(5) Fusees may be packed with non-explosive or non-flammable articles provided the outside packages are marked as prescribed in this section.

§ 73.155 Bags, sodium nitrate, empty and unwashed. (a) Bags, sodium nitrate, empty and unwashed, must be packed in specification containers as follows:

(1) Spec. 15A, 15B, 15C, 16A, or 19A. Wooden boxes.

(2) Spec. 10A, 10B, 10C, 11A, or 11B. Wooden barrels.

(b) Bags in carload lots loaded by consignor and to be unloaded by consignee may also be shipped loose or baled, provided the car is lined with paper, doors of cars are properly stripped after sealing, and provision is made to prevent entrance of sparks.

§ 73.156 Barium peroxide and calcium peroxide. (a) Barium peroxide and calcium peroxide must be packed in specification containers as follows:

(1) Spec. 15A, 15B, 15C, 16A, 19A or 19B. Wooden boxes with inside glass containers not over 1 pound capacity each; or with inside glass containers not over 5 pounds capacity each cushioned with incombustible cushioning material; or with inside metal containers or lining, spec. 2F.

(3) Spec. 6B or 6C. Metal barrels or drums with not more than 1400 pounds net weight in each container.

(4) Spec. 17E, 17H, 37A, or 37B. Metal drums (single-trip).

(5) Spec. 21C. Fibre drums. Authorized net weight not over 225 pounds.

§ 73.157 Benzoyl peroxide, chlorobenzoyl peroxide (para), cyclohexanone peroxide, 2, 5 dimethyl-2, 5 dihydroperoxy hexane, lauroyl peroxide, or succinic acid peroxide, wet. (a) Benzoyl peroxide, chlorobenzoyl peroxide (para), cyclohexanone peroxide over 50 per cent concentration but not exceeding 85 per cent concentration, 2,5 dimethyl-2,5 dihydroperoxy hexane, lauroyl peroxide, and succinic acid peroxide, wet with at least 30 per cent of water by weight, except cyclohexanone peroxide, must be packed in specification containers as follows:

(1) Spec. 15A, 15B, 15C or 19B. Wooden boxes with inside metal containers or lining, spec. 2F or with inside paper bags lined with polyethylene at least 0.002 inch thick and not over 1-pound dry weight capacity each; or aluminum drums of at least 16 gauge United States standard, tightly sealed. Gross weight not over 200 pounds.

(3) Spec. 12B. Fibreboard boxes, with inside fibre containers securely closed by taping or gluing, or inside securely closed paper bags lined with 0.002 inch thick polyethylene, not over 1 pound capacity each. Except for lauroyl peroxide, wet, each inside container must be surrounded by asbestos or fire-resistant cushioning material which will protect the contents with equal efficiency. Gross weight in spec. 12B65 boxes may be more than 65 but not more than 80 pounds provided net weight of contents does not exceed 50 pounds.

(4) Spec. 21C. Fibre drums. Authorized only for cyclohexanone peroxide over 50 per cent concentration but not exceeding 85 per cent concentration, benzoyl peroxide wet with at least 30 per cent water, and 2, 5 dimethyl-2, 5 dihydroperoxy hexane, which materials must be packed in plastic inside container, securely closed, and formed of polyethylene film sheets having minimum thickness of 0.002 inch except for benzoyl peroxide wet with at least 30 per cent water, which shall require a minimum thickness of 0.004 inch. Authorized net weight in one outside container shall not exceed 50 pounds for cyclohexanone peroxide, 100 pounds for 2, 5 dimethyl-2, 5 dihydroperoxy hexane, and 225 pounds for benzoyl peroxide.

(5) Spec. 12B. Fibreboard boxes having inside polyethylene bags constructed of material having minimum thickness of 0.004 inch. The capacity of each bag must not exceed 10 pounds. Each bag must be surrounded by asbestos, or other fire-resistant cushioning material which will protect the contents with equal efficiency. Gross weight must not exceed 65 pounds. Authorized only for benzoyl peroxide.

(b) Benzoyl peroxide, wet with at least 20 percent of water by weight, must be packed in specification containers as follows:

(1) Spec. 12B. fibreboard box with securely closed inside paper bags lined with polyethylene at least 0.002 inch thick. The net weight (dry weight) in each bag may not exceed 1 pound. Each bag must be surrounded by an appropriate fire-resistant cushioning material.

(2) spec. 21C. Fibre drum with securely closed inside plastic containers made of polyethylene film at least 0.004 inch thick. Net weight (dry weight) in each outside drum may not exceed 55 pounds.

(3) Spec. 12B. Fibreboard box with securely closed inside

plastic containers made of polyethylene film at least 0.004 inch thick. The net weight (dry weight) in each inside container may not exceed 25 pounds. Each inside container must be surrounded by an appropriate fire-resistant cushioning material. The net weight (dry weight) in each outside box may not exceed 50 pounds.

§ 73.158 Benzoyl peroxide, dry; chlorobenzoyl peroxide (para) dry; cyclohexanone peroxide, dry; lauroyl peroxide, dry; or succinic acid peroxide, dry. (a) Benzoyl peroxide, dry; chlorobenzoyl peroxide (para), dry; cyclohexanone peroxide over 50 per cent concentration but not exceeding 85 per cent concentration, dry; lauroyl peroxide, dry; must be packed in specification packagings as follows:

(1) Spec. 15A, 15B, 19A or 19B. Wooden boxes, with inside fibre containers securely closed by taping or gluing, or inside securely closed paper bags lined with 0.002 inch thick polyethylene, not over 1 pound capacity each. Except for lauroyl peroxide, dry, each inside container must be surrounded by asbestos or fire-resistant cushioning material which will protect contents with equal efficiency. Net weight in outside container must not exceed 50 pounds, except that for lauroyl peroxide, dry, net weight not over 100 pounds is authorized.

(2) Spec. 21C. Fibre drums. Authorized only for lauroyl peroxide, dry, Authorized net weight not over 100 pounds in one drum.

(3) Spec. 12B. Fibreboard boxes, with inside fibre containers securely closed by taping or gluing, or inside securely closed paper bags lined with polyethylene not less than 0.002 inch thick, not over 1 pound capacity each. Except for lauroyl peroxide, dry, each inside container must be surrounded by asbestos or fire-resistant cushioning material which will protect the contents with equal efficiency. Gross weight in spec. 12B65 boxes may be more than 65 but not more than 80 pounds provided net weight of contents does not exceed 50 pounds.

§ 73.160 Calcium chlorite and sodium chlorite. (a) Calcium chlorite and sodium chlorite must be packed in specification containers as follows:

(1) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes with inside containers which must be glass or earthenware not over 2¼ pounds capacity each or metal not over 5 pounds capacity each.

(2) Spec. 6B, or 6C. Metal barrels or drums.

(3) Spec. 17E, 17H, 37A, or 37B. Metal drums (single-trip).

§ 73.161 Calcium phosphide. (a) Calcium phosphide must be packed in specification containers as follows:

(1) Spec. 15A, 15B, or 19B. Wooden boxes lined, spec. 2F, and with hermetically sealed inside containers.

(2) Spec. 6B, or 6C. Metal barrels or drums.

§ 73.162 Charcoal. (a) Charcoal as described in this paragraph is exempt from specification packaging requirements for transportation by rail freight.

(1) Charcoal, activated.

(2) Charcoal made from pine wood and processed so that it is not liable to heat dangerously or cause fires in transportation.

(3) Charcoal briquettes made from wood charcoal with starch and water, or tar, for a binder, which have been screened and cooled to a temperature below 100°F,. before being offered for transportation.

(4) Charcoal screenings made from "pinon" wood.

(5) Charcoal made from walnut shells, corn cobs, peach pits, and similar material, must be cooled and held not less than five days before shipment, and shipped in bags, barrels, or boxes. The five-day holding period shall not apply to charcoal briquettes screened and cooled to a temperature below 100°F. before being offered for transportation.

(6) Charcoal, lump, made by the old kiln or pit method by which long air exposure is provided before shipment.

(7) Charcoal, wood, except charcoal screenings, when packed in boxes or barrels.

(8) Charcoal, wood, when in bags in less-than-carload shipments of not exceeding 2,000 pounds.

(9) When offered for transportation by rail express, charcoal, except charcoal briquettes, must be packed in barrels, bags, or boxes.

(10) Charcoal screenings or ground, crushed, granulated, or pulverized charcoal, from pit or kiln burned charcoal, provided the screenings or the material from which the ground charcoal is made has been exposed to the air for not less than 5 days prior to shipment or grinding (see paragraph (j) and (k) of this section).

(b) Charcoal made in round retorts must be transferred to air-tight metal cans for cooling, and must be kept in these cans for 24 hours or more. The charcoal after removal from these cans should be aired by a spreading on a floor to a depth not exceeding 1 foot. This air exposure must last not less than 44 hours. Not less than 72 hours should elapse from the time the air exposure of the charcoal commences before a car loaded with it is closed for shipment, or before the lump charcoal is placed in paper bags.

(1) The charcoal during this airing period must be protected from the weather, and exposed to good circulation of air. When the charcoal is aired on the floor for only 24 hours and then placed in burlap bags, it must be kept in the bags 60 hours before shipment. If the charcoal is not aired on the floor for at least 24 hours, it must be kept in the burlap bags for at least 96 hours before loading for shipment.

(c) Charcoal made in ovens in slatted cars should be kept for two periods of 24 hours each in first and secondary air-tight cooling chambers respectively. After removing the charcoal from the secondary coolers it must be exposed to good air circulation but protected from the weather for a period of not less than 44 hours.

(1) Not less than 72 hours must elapse from the time the air exposure of the charcoal commences before a car loaded with it is closed for shipment, or before the lump charcoal is placed in paper bags.

(d) When fire occurs in charcoal during air exposure period, it should be extinguished with as little water as possible. Any charcoal wet in this way or otherwise must be dried, by again heating in the retorts or ovens, and cooled and aired in the usual way described in paragraphs (b) and (c) of this section, or the charcoal must be set aside and allowed to dry for not less than 30 days before shipment.

(e) Charcoal, lump, must be dry and free from screenings and brands.

(1) Shipments must be loaded into tight box cars, tight container cars, or into tight closed-up hopper cars, except that lump

charcoal made from soft wood may be shipped in open or stock cars.

(2)When a chute is used in loading the car, the chute must contain a properly constructed screen which must be kept clean. This screen shall be not less than ¾ inch mesh. Forks with prongs not less than 1 inch apart must be used instead of shovels to handle the charcoal. The screenings which accumulate in the doorway of the car must be removed before loading the doorway. The car should be swept before loading, and a car which has contained lime must be thoroughly cleaned before loading with charcoal. The doors of the car must be closed tightly before the car is forwarded.

(3) Lump charcoal may be shipped in bags, barrels or boxes, or bulk in cars.

(f) Charcoal screenings consist of small pieces of charcoal varying from about one-half inch in the maximum dimension to grains of dust. These screenings are more liable to produce fires than other forms of charcoal. Charcoal screenings from wet charcoal or wet screenings or screenings which have been wet must not be offered for shipment unless they have been dried for not less than 12 hours in a retort or oven, and then subjected to not less than 10 days airing and cooling before shipment.

(1) Charcoal screenings must be stored in a dry place, in loosely piled bags, freely exposed to the air for not less than 20 days after separation from the lump before shipment.

(2) Screenings from pine-wood charcoal must be stored as above described for not less than five days before shipment.

(3) Charcoal screenings must be packed in cotton or jute bags of not greater than 4 bushels capacity.

(4) Charcoal screenings, except screenings made from "pinon" wood, must not be offered for transportation by rail express.

(g) Charcoal ground, crushed, granulated, or pulverized is prepared from either lump charcoal or screenings.

(1) Lump charcoal used for the preparation of ground, crushed, granulated, or pulverized charcoal must be stored subject to ventilation, and protected from the weather for not less than 20 days after its removal from the coolers before milling; or the ground, crushed, granulated or pulverized charcoal must be stored in bags, subject to ventilation and protected from the weather for not less than 20 days before shipment. Lump charcoal made from pine wood must be stored as above described for not less than 5 days before milling. Ground, crushed, or granulated charcoal made by the "Stafford" process must be stored subject to ventilation and protected from the weather for not less than 7 days before shipment in lieu of the 20-days' storage otherwise prescribed.

(2) Charcoal screenings used for the preparation of ground, crushed, granulated, or pulverized charcoal must be stored in a dry place in loosely piled cotton or jute bags freely exposed to air for a period of not less than 20 days after separation from the lump charcoal, and before milling; or the ground, crushed, granulated, or pulverized charcoal must be stored in bags, subject to ventilation and protected from the weather for not less than 20 days before shipment. Charcoal screenings made from pine wood charcoal must be stored as above described not less than 5 days before milling.

(3) Ground, crushed, granulated, or pulverized charcoal must be packed in tight sift-proof wooden barrels or boxes containing not more than 4 bushels each; or in fibreboard boxes; or in unlined jute bags, or in strong unlined cotton bags, containing not more than 4 bushels each; or in paper-lined jute bags, or in paper bags, containing not more than 2½ bushels each. Whenever practicable, all boxes, barrels, or bags, after filling, should be allowed to remain open and freely exposed to the air, and protected from the weather for not less than 24 hours before being closed. Ground, crushed, granulated, or pulverized charcoal made from pine-wood charcoal should be so stored for not less than 72 hours before the packages are closed.

(h) Charcoal, screenings or ground, crushed, granulated or pulverized charcoal, in bags, when loaded in cars for shipment by rail must be so loaded that the bags are laid horizontally in the car, and so piled that there will be spaces for efficient air circulation. These spaces must be not less than 4 inches wide. If the bags are not compactly filled and closed so as to avoid free space within, transverse wooden strips must be laid between the bags and extending the full width of the car; these strips should be approximately 2 feet apart vertically and longitudinally. The bags must not be piled closer than 6 inches from the top of the car, and no more than 26,000 pounds of screenings, ground, granulated, crushed, or pulverized charcoal, shall be loaded in a 36-foot, 6-inch car, 27,000 pounds in a 37-foot, 6-inch car, 28,000 pounds in a 38-foot, 6-inch car, 29,000 pounds in a 39-foot, 6-inch car, 36,000 pounds in a 40-foot, 6-inch car, and 50,000 pounds in a 50-foot, 6-inch car. A tight car must be used, and any loose material must be swept up and removed from the doorway of the car before completing the loading.

(j) Charcoal burned in pits or kilns must be thoroughly cooled in the sealed kilns. After the kilns are opened, the charcoal must be allowed to stand in the open kiln or elsewhere exposed to the air for not less than 24 hours before loading in a freight car. Charcoal burned in kilns may be loaded in open cars or in box cars, but after loading in box cars, the cars must be allowed to stand not less than 24 hours with doors open before shipment.

(k) Screenings, or ground, crushed, granulated, or pulverized charcoal, from pit or kiln burned charcoal, are considered as non-hazardous, provided the screenings or the material from which the ground charcoal is made has been exposed to the air not less than 5 days prior to shipment or grinding.

(l) Reburned charcoal must be cooled and exposed to good fresh-air circulation for not less than five days after removal from the reburning furnaces and before being shipped or ground to produce ground or pulverized charcoal.

§73.163 Chlorate of soda, potassium chlorate, and other chlorates. (a) Sodium chlorate, dry, and hydrated calcium hypochlorite, potassium chlorate and other chlorates must be packed in specification containers as follows:

(1) Spec. 6B, or 6C. Metal barrels or drums.

(2) Spec.17E, 17H, 37A, or 37B. Metal drums (single-trip).

NOTE 1: Spec. 37A and 37B. Metal drums for export service marked for an authorized gross weight of 160 pounds, must be at least 24 gauge metal throughout.

(3) Spec. 21C, 22A or 22B. Fibre or plywood drums with inside metal drums, spec. 2F. Authorized net weight not over 225 pounds.

(4) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes, or spec. 11A or 11B, wooden barrels or kegs, with tightly closed inside containers which must be of metal not over 10 pounds capacity each; or of glass not over 5 pounds each; or of fibre, spec. 2G, not over 6 pounds capacity each.

(5) Spec. 12B. Fibreboard boxes with inside metal cans not over 5 pounds capacity each, closed air tight, and with not over 25 pounds of chlorate in the outside container.

(6) Chlorates wet with 10 per cent or more of water are authorized for shipment in tank cars, spec. 103[1], 103-W, 111A60-F-1, or 111A60-W-1, when equally distributed therein.

(7) Sodium chlorate, dry, and hydrated calcium hypochlorite, is authorized for shipment in aluminum or steel tank car tanks, steel cargo tank vehicles, tight sift-proof covered hopper cars, or tight sift-proof covered hopper type motor vehicles. Tank car tanks, cargo tank vehicles, hopper cars, and hopper type motor vehicle must be thoroughly cleaned before loading.

(8) Spec. 12A. Fibreboard boxes with inside glass or plastic bottles not over 5 pounds capacity each. Not more than 4 glass bottles or 6 plastic bottles shall be packed in one outside container. Shipper must have established that completed package meets test requirements prescribed by Paragraph 10 of Spec. 12A.

(9) Spec. 56. Metal portable tanks.

§ 73.164 Chromic acid. (a) Chromic acid must be packed in specification containers as follows:

(1) Spec. 6B, or 6C. Metal barrels or drums.

(2) Specs. 17E, 17H, 37A, or 37B. metal drums (single-trip.) spec. 37A metal drums constructed of 22-gauge steel are authorized for a gross weight of 490 pounds when shipped in carload lots only.

(3) Spec. 15A, 15B, or 19B. Wooden boxes, with inside glass bottles of not greater than 5 pounds capacity each, with closures securely fastened, each bottle individually packed in a tight metal container, and cushioned therein with incombustible mineral packing material; or with tightly closed metal inside containers, not over 10 pounds capacity each.

(4) Spec. 12A. Fibreboard boxes with inside glass bottles not over 5 pounds capacity each. Not more than four bottles having capacity of 5 pounds each, shall be packed in one outside container. Shipper must have established that completed package meets test requirements prescribed by Paragraph 10 of Spec. 12A.

(5) Spec. 12B. Fibreboard boxes with metal inside containers which must have closing device securely fastened by positive means (not friction), not over 1-gallon capacity each. Not more than 4 metal containers shall be packed in one outside box.

(6) Spec. 21C. Fibre drums lined with a saran plastic material having a minimum thickness of .002 inch. Authorized net weight nor over 115 pounds.

(7) Spec. 56. Steel portable tank.

§ 73.166 Cobalt resinate, precipitated, calcium resinate, and calcium resinate fused. (a) Cobalt resinate, precipitated, calcium resinate, and calcium resinate fused, must be packed in specification containers as follows:

(1) Spec. 6B, or 6C. Metal barrels or drums.

(2) Spec. 17E, 17H, 37A, or 37B. Metal drum (single-trip).

(3) Spec. 15A or 15B. Wooden boxes with air-tight metal inside containers.

§ 73.167 Cotton waste, oily. (a) cotton waste, oily with more than 5 per cent of vegetable or animal oil must be packed as follows:

(1) In hermetically sealed metal-lined wooden boxes or air-tight metal containers.

(b) Such cotton waste must not be offered for transportation by carriers by rail express.

§ 73.168 Lithium amide, powdered. (a) Lithium amide, powdered, must be packed as follows:

(1) As prescribed in § 73.154(a), (1), (2), (5), (8) and (11) of this part.

(2) Spec. 21C. Fibre drums with inside metal drums, spec. 2F. Authorized net weight not over 225 pounds.

§ 73.169 Fibre, burnt. (a) Fibre, burnt, must be packed in hermetically sealed metal-lined wooden boxes or air-tight metal containers.

(b) Such fibre must not be offered for transportation by rail express.

§ 73.170 Fibres or fabrics impregnated, saturated or coated. (a) Fibres or fabrics impregnated, saturated or coated with animal or vegetable oils, or organic substances, manufactured articles or processed materials which are liable to spontaneous heating or combustion in transit must be packed in hermetically sealed metal-lined wooden boxes or air-tight metal containers

(b) Such materials, substances or articles must not be offered for transportation by rail express.

§ 73.171 Fish scrap or fish meal. (a) Fish scrap or fish meal containing less than 6 or more than 12 per cent moisture (does not include wet acidulated fish scrap with moisture 40 to 55 per cent), or which has not been sufficiently cooled after manufacture, or is liable to spontaneous heating in transit, must be packed in air-tight metal containers.

(b) such fish scrap or fish meal must not be offered for transportation by rail express.

§ 73.174 Iron sponge, spent oxide, spent iron mass, or spent iron sponge. (a) Iron sponge that has not been properly oxidized during manufacture must be packed in hermetically sealed metal-lined wooden boxes or air-tight metal containers.

(b) Iron sponge not properly oxidized must not be offered for transportation by carriers by rail express.

(c) Spent oxide, spent iron mass, or spent iron sponge must be loaded in open steel cars.

(d) Spent oxide, spent iron sponge, or spent iron mass must not be offered for transportation by carrier by rail express.

§ 73.175 Lacquer base, or lacquer chips, dry. (a) Lacquer base, or lacquer chips, dry, must be packed in specification containers as follows:

(1) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes with inside metal containers, spec. 2F.

(2) Spec. 6B or 6C. Metal barrels or drums.

(3) Spec. 17E, 17H, 37A, 37B, or 37C. Metal drums (single-trip), or spec. 37C (non-reusable containers).

(4) Spec. 21C. Fibre drums. Authorized net weight not over 225 pounds.

§ 73.176 Safety Matches. (a) Safety matches (strike on box, book and card), which are intended to be ignited on a prepared

[1] Use of existing tank cars authorized, but new construction not authorized.

surface, must be of a type which will not ignite spontaneously or undergo marked decomposition when subjected for eight consecutive hours to a temperature of 200°F (93.3°C).

(b) Safety matches must be tightly packed in securely closed inside packagings to prevent accidental ignition under conditions normally incident to transportation, and further packed in outside fibreboard, wooden, or other equivalent-type packagings. Safety matches in outside packaging not exceeding 50 pounds gross weight are not subject to any other requirement of this part. Safety matches may be packed in the same outside packaging with materials not subject to this part.

§ 73.176a Strike anywhere matches. (a) Strike anywhere matches, which may be ignited by friction on a solid surface, must be of a type which will not ignite spontaneously or undergo marked decomposition when one complete inside package is subjected for eight consecutive hours to a temperature of 200°F (93.3°C).

(b) Strike anywhere matches may not be packed in the same outside packaging with any material other than safety matches. The safety matches must be packed in separate inside packagings.

(c) Inside packagings. Strike anywhere matches must be tightly packed in securely closed chipboard, fiberboard, wooden, or metal inside packagings to prevent accidental ignition under conditions normally incident to transportation. Each inside packaging may contain no more than 700 strike anywhere matches.

(d) Outside packagings. Strike anywhere matches must be packed as follows:

(1) Spec. 15A or 19B. Wooden boxes, with inside packages. Gross weight must not exceed 100 pounds.

(2) Spec. 12B or 12C. Fibreboard boxes, with inside packages. Gross weight must not exceed 60 pounds. Fill-in pieces specified in paragraph 14 of specs. 12B and 12C are not required.

§ 73.177 Motion-picture film and X-ray film. (a) Motion-picture film and X-ray film (nitrocellulose base) (exposed) must be packed in specification containers as follows:

(1) Spec. 32A or 32B. Metal cases.

(2) Spec. 15A, 15B, 15C or 19B. Wooden boxes with each reel in a tightly closed metal can, or strong cardboard or fibreboard box with cover held in place by adhesive tape or paper; gross weight not over 200 pounds.

(3) Spec. 12B. Fibreboard boxes complying with paragraph 22(a)(1) of spec. 12B; authorized for a single tightly closed inside metal can or strong cardboard or fibreboard box with cover held in place by adhesive tape or paper, not over 2,000 feet of film. Taped closure authorized.

(4) Spec. 12B. One-piece fibreboard boxes complying with paragraph 22(a)(2) of spec. 12B; authorized only when each film is in a tightly closed metal film-reel can or strong cardboard or fibreboard box with cover held in place by adhesive tape or paper containing not over 2,000 feet (approximately) of film; cans or boxes to be adequately braced in centre of box by fibreboard, at least 175-pound test, extending full depth of box. Gross weight not over 65 pounds. Closing of box must be effected by coating entire contact surfaces of flaps with efficient adhesive; stitched closure not authorized. Boxes that have been filled, shipped, and opened, are not authorized for reuse.

(5) Spec. 32C. Trunks with each film in standard metal film-reel can or strong cardboard or fibreboard box with cover held in place by adhesive tape or paper. Trunks to contain no material other than films in cans or boxes and projecting apparatus. The apparatus, as packed, must not be capable of creating an electric current.

(6) Spec. 12B. Fibreboard boxes complying with paragraph 27 of spec. 12B; authorized only for not more than two square inside metal cans containing not over 200 feet (approx.) of film each; gross weight not over 15 pounds. Taped closure authorized.

(b) Slow burning motion-picture film is exempted from the requirements of this part, except when packed with flammable film.

§ 73.178 Calcium carbide, calcium silicon powder, and magnesium granules, coated. (a) Calcium carbide, calcium silicon powder, and magnesium granules, coated, shall be packed:

(1) In water-tight metal drums, with rolled, folded top and bottom seams and with welded side seams. Closures shall be of the friction-type or screw-type. Full open top closures shall be gasketed and equipped with leverlock or bolted clamping ring. Maximum rated capacity shall not exceed 250 litres,

(2) in water-tight, sift-proof bulk metal containers,

(3) in water-tight, sift-proof, closed-top metal cover hopper rail cars approved by the Committee, or

(4) in water-tight metal containers not exceeding 5 kg net weight.

§ 73.182 Nitrates. (a) Aluminum nitrate, ammonium nitrate ammonium nitrate-carbonate mixture, ammonium nitrate-phosphate, ammonium nitrate fertilizer, (containing no more than 0.2 percent carbon), ammonium nitrate mixed fertilizer, barium nitrate, beryllium nitrate, calcium nitrate, ferric nitrate, guanidine nitrate, lead nitrate, magnesium nitrate, mercuric nitrate, nickel nitrate, nitrates, n.o.s., nitrate of soda and potash, potassium nitrate, silver nitrate, sodium nitrate, strontium nitrate, zinc nitrate and zirconium nitrate may be packed as follows:

(1) In wooden or fibreboard boxes with glass, metal, or other strong inside containers; in metal or fiber drums; in kegs or barrels; or in strong metal cans. When so packed, they are excepted from the specification packaging requirements of this part.

(2) The double salt of calcium and ammonium nitrate ($5Ca(NO_3)_2NH_4NO_3 1OH_20$) containing not more tan 15.5 percent nitrogen and at least 12 percent water is not subject to these regulations.

(b) Aluminum nitrate, ammonium nitrate (no organic coating), ammonium nitrate-carbonate mixture, ammonium nitrate-phosphate, ammonium nitrate fertilizer (containing no more than 0.2 percent carbon) ammonium nitrate mixed fertilizer, barium nitrate, beryllium nitrate, calcium nitrate, ferric nitrate, guanidine nitrate, mercuric nitrate, nickel nitrate, nitrate of soda and potash, potassium nitrate, sodium nitrate, strontium nitrate, and zirconium nitrate may, in addition to containers prescribed in paragraph (a) of this section, be packaged as follows:

(1) In bulk, in tightly closed freight cars.

(4) In burlap bags not exceeding 200 pounds net weight, water resistant, made tight against sifting, and made of not less than 7½ ounce burlap.

(5) In multiple wall paper bags constructed as follows:

(i) At least 4-ply including moisture — barrier ply, and made tight against sifting. Maximum authorized net weight is 110 pounds. Completed package, filled to weight with product and closed for shipment, must be capable of withstanding three 4-foot drops on face or back onto solid concrete without rupture.

(ii) At least 3-plies of extensible kraft paper having a minimum total basis weight of 180 pounds including an innermost ply coated with polyethylene to provide a moisture barrier. Maximum authorized net weight is 80 pounds. Completed package, filled to weight with product and closed for shipment, must be capable of withstanding three 4-foot drops on face or back onto solid concrete without rupture.

(6) In plastic bags constructed as follows:

(i) Spec. 44P. All plastic bags. Maximum authorized net weight is 81 pounds. Authorized only for ammonium nitrate mixed fertilizer, ammonium nitrate fertilizer (containing no more than 0.2 percent carbon), and potassium nitrate.

(ii) Polypropylene bag made of 9 denier polypropylene fibres spun continuously to form a sheet weighing at least 3½ ounces per square yard. Maximum authorized net weight is 100 pounds. Each bag must have an inner liner of polyethylene not less than 4 mills thick. Each bag filled to weight with product and closed for shipment must be capable of withstanding three 4-foot drops on face or back onto solid concrete without rupture. Authorized only for ammonium nitrate (no organic coating), ammonium nitrate fertilizer, and potassium nitrate; or

(iii)Polyethylene bag made of two plies of high-density polyethylene film laminated together so that the orientation of each ply of film is at right angles to the other. Maximum authorized net weight is 100 pounds. For a net weight not exceeding 50 pounds, the thickness of each bag must be at least 2.5 mils. For a net weight exceeding 50 pounds but not exceeding 100 pounds, the thickness of each bag must be at least 4 mils. Each bag must be capable of withstanding the test requirements of paragraph 4 of spec. 44P and each bag must be in compliance with the requirements of paragraph 3 of spec. 44P for bag closures. Authorized only for ammonium nitrate (no organic coating), ammonium nitrate fertilizer, and sodium nitrate.

(7) Spec. 56. Portable tanks. Authorized only for sodium nitrate.

(c) Explosives, blasting, division 1.5, in addition to the containers prescribed in paragraph (a) of this section, may be packed as follows:

(1) In burlap bags not exceeding 100 pounds net weight, water-resistant, made tight against sifting, and made of not less than 7½ ounce burlap.

(2) In multi-wall paper bags not exceeding 100 pounds net weight, made of at least 4-ply construction including moisture-barrier ply, and made tight against sifting. Completed package, filled to weight with product and closed as for shipment, must be capable of withstanding three 4-foot drops on the face or back onto solid concrete without rupture.

§ 73.183 Potassium nitrate mixed (fused) with sodium nitrite. (a) Potassium nitrate mixed (fused) with sodium nitrite must be packed in containers as follows:

(1) In containers as prescribed in § 73.182(a).

(2) Spec. 103-W. Tank cars specially designed, equipped and approved for this service without bottom discharge outlet and with heavier plate thicknesses than the minimum prescribed for cars built under this specification. For specification 103-W tank cars made of plates having the minimum prescribed thicknesses, internal reinforcement of the upper sheets of tank in the region of the dome and reinforcing plates attached to the bottom sheet of the tank which rests on bolsters is required, and these tanks must be equipped with baffle plates. Heater pipes must be of welded construction designed for a test pressure of 500 pounds per square inch. A 1-inch woven asbestos lining must be placed between bolster slabbing and bottom of tank to prevent heat transmission. If safety valves are used, a vacuum relief valve must be installed on the dome.

§ 73.184 Nitrocellulose or collodion cotton, wet, or nitrocellulose colloided, granular, or flake, wet, or nitrostarch, wet, or nitroguanidine, wet. Nitrocellulose wet, or nitrocellulose colloided, granular, or flake, wet, or nitrostarch, wet, or nitroguanidine, wet, must be uniformly wet with at least 20 pounds of water to 80 pounds of dry material and must be packed in specification containers as follows:

(1) Spec. 10A or 10B. Wooden barrels or kegs.

(2) Spec. 14, 15A, 15B, or 19B. Wooden boxes lined, spec. 2M.

(3) Spec. 6B, 6C, or 6J. Metal barrels or drums not over 46 gallons capacity. Spec. 6J drums must have removable heads of 14 gauge metal or 16 gauge metal with one or more corrugations near the periphery and heads must have a minimum convexity of ⅜ inch; each drum must have three rolled or swedged-in hoops, one of which shall be in the body near the top curl.

(4) Spec. 37A or 37B. Metal drums (single-trip) not over 5 gallons capacity. Welded side seams required.

(5) Spec. 17E or 17H. Metal drums (single-trip).

(b) Gross weight of any container must not exceed 490 pounds.

§ 73.187 Potassium peroxide, potassium superoxide, sodium peroxide and sodium superoxide. (a) Potassium peroxide, potassium superoxide, sodium peroxide or sodium superoxide must be packed in specification containers as follows:

(1) Spec. 11A, 11B, 15A, 15B, 15C, 16A, 19A, or 19B. Wooden barrels, kegs, or boxes, with inside containers which must be air-tight metal cans.

(2) Spec. 6B, or 6C. Metal barrels or drums.

(3) Spec. 17E, 17H, 37A, or 37B. Metal drums (single-trip).

(4) Spec. 12A or 12B. Fibreboard boxes with inside air-tight metal cans not over 5 pounds capacity each.

§ 73.188 Phosphoric anhydride. (a) Phosphoric anhydride must be packed in specification containers as follows:

(1) Spec. 11A, 11B, 15A, 15B, 15C, or 19B. Wooden barrels, kegs, or boxes, with inside containers which must be tightly stoppered glass bottles not over 1 pound capacity each; or metal cans, not over 3 pounds capacity each, hermetically sealed (soldered) or closed with cork securely held in place by metal strap soldered in position. All inside containers must be cushioned with elastic incombustible packing material.

NOTE 1: Until further order of the Commission, metal cans not over 6 pounds capacity each are authorized.

(2) Spec. 6B, or 6C. Metal barrels or drums.

(3) Spec. 17E, 17H, 37A, or 37B. Metal drums (single-trip).

(4) Spec. 56. Stainless steel portable tanks.

(5) Spec. 12A. Fibreboard boxes with inside glass bottles not over 1 pound capacity each. Not more than 12 bottles shall be packed in one outside box. Shipper must have established that completed package meets test requirements prescribed by Paragraph 10 of Spec. 12A.

(6) Spec. 12A. Fibreboard boxes with inside glass bottles of 1/3 fluid ounce capacity each. Each bottle shall be packed in a heat-sealed polyethylene or other suitable plastic bag of equal efficiency and not more than 75 such units shall be packed in a heat-sealed polyethylene or other suitable plastic bag of equal efficiency, which shall be placed in a securely closed metal can. Not more than 1 can shall be packed in one outside box.

§ 73.189 Phosphorus, amorphous, red. (a) Phosphorus, amorphous, red, must be packed in specification containers as follows:

(1) Spec. 15A, 15B, or 19B. Wooden boxes, with metal inside containers, with closures sealed air-tight and positively fastened.

(2) Spec. 6B; also 37A or 37B (single-trip container). Metal barrels or drums, not over 25 gallons capacity each.

(3) Spec. 29. Mailing tube having not more than 100 grams of phosphorus contained in an inside glass container, sealed under nitrogen or other inert gas, with an air tight closure. The glass container shall be packed in a metal can having air tight closure. Both the inside glass container and the metal can shall be surrounded on all sides with incombustible cushioning material.

§ 73.190 Phosphorus, white or yellow. (a) Phosphorus, white or yellow, when offered for transportation by carriers by rail freight, may only be packed dry or in water.

(b) When placed in water it must be packed in specification containers as follows:

(1) Spec. 15A, 15B, or 19B. Wooden boxes with inside containers, which must be hermetically sealed (soldered) metal cans, inclosed in other hermetically sealed (soldered) metal cans; or hermetically sealed (soldered) metal cans, containing not over 1 pound each, inclosed in other, watertight, metal cans with screw-top closures; or hermetically sealed (soldered) metal cans, enclosed in hermetically sealed (soldered) metal containers, spec. 2F.

(2) Spec. 5A, or 6B. Metal barrels or drums, not over 25 gallons capacity each.

(3) Spec. 103[1], 103-W, 111A60-F-1 or 111A60-W-1 tank cars without bottom outlet for discharge of lading and with approved dome fittings, external heater systems, and with insulation at least 4 inches in thickness, except that thickness of insulation may be reduced to 2 inches over external heater coils. Bottom washout nozzle of approved design may be applied. The material must be immersed in water or be blanketed with an inert gas and be loaded at a temperature not exceeding 140°F. The water must be loaded in the dome to not more than 50 per cent of the capacity of the dome. After unloading, the tank must be filled to its entire capacity with an inert gas or to its entire capacity and the dome to not more than 50 per cent of its capacity with water having a temperature not exceeding 140°F.

NOTE 1: Until further order of the Commission, Specification ARA-III[1] tank cars, converted as follows are authorized for use: Without bottom discharge outlet, with insulation at least 2 inches in thickness, internal heater coils, at least one safety valve or fangible disc safety vent of approved design, and dome equipped for top unloading. Cars to be loaded and unloaded as prescribed in paragraph (b) (3) of this section.

(c) Phosphorus, white or yellow, when offered for transportation by rail express must be packed in water in specification containers as follows (also authorized for transportation by carriers by rail freight).

(1) Spec. 15A, 15B, 19A, or 19B. Wooden boxes with inside containers which must be hermetically sealed (soldered) metal cans, containing not over 1 pound each, enclosed in other, watertight, metal cans with screw-top closures, or with soldered closures.

(2) Samples of phosphorus, white or yellow, not to exceed 4 ounces each, placed in water in sealed metal cylinders or cans, enclosed in a wooden box, spec. 15A or 15B, may be transported only when consigned to laboratories of the Government of Canada.

(3) Spec. 29. Mailing tube having a watertight rigid polyethylene container in which is placed a quartz tube containing not more than 100 grams of phosphorus sealed under nitrogen or other inert gas, with the remaining space in the polyethylene container filled with water. The polyethylene container shall be cushioned within the mailing tube with incombustible cushioning material.

(d) Phosphorus, white or yellow, when dry must be cast solid and shipped in containers as follows:

(1) Spec. 6B, or 6C. Metal barrels or drums not over 25 gallons capacity each.

(2) In projectiles or bombs when shipped by, for, or to the Department of National Defence, without bursting elements.

(e) Phosphorus, white or yellow, when dry must not be offered for transportation by rail express.

§ 73.191 Phosphorus pentachloride. (a) Phosphorus pentachloride must be packed in specification containers as follows:

(1) Spec. 11B, 15A, 15B, 15C, 16A, 19A, or 19B. Wooden barrels, kegs, or boxes, with inside containers which must be glass or glazed earthenware containers, not over 25 pounds capacity each, cushioned with mineral packing; when inside containers are packed in the same outside container with other articles, they must be enclosed in tightly closed metal cans. Net weight of phosphorus pentachloride not over 50 pounds in each outside container.

(2) Spec. 6B, or 6C; also 37A or 37B (single-trip containers). "Black iron" metal barrels or drums.

§ 73.192 Picrate of ammonia (ammonium picrate), picric acid, trinitrobenzoic acid, and urea nitrate, wet. (a) Picrate of ammonia (ammonium picrate), picric acid, trinitrobenzoic acid, and urea nitrate, wet with not less than 10 per cent water, in quantity not exceeding 16 ounces in one outside package, may be shipped as drugs, medicines, or chemicals, when in glass bottles securely stoppered, each bottle enclosed in a strong fibre carton properly cushioned in the outside shipping case. No restrictions other than packing prescribed by this section are required when these materials are offered for transportation.

§ 73.193 Picric acid, trinitrobenzoic acid, or urea nitrate, wet. (a) Picric acid, trinitrobenzoic acid, or urea nitrate, wet with not less than the percentage of water specified in § 72.5 must be packed as follows:

(1) Spec. 15A or 19B. Wooden boxes with inside glass or earthenware containers, cushioned and tightly closed. The net

[1] Use of existing tank cars authorized, but new construction not authorized.

weight in an outside package must not exceed 25 pounds dry weight.

(2) Spec. 21C. Fibre drums of not over 6½ gallons capacity with one inside 5-mil polyethylene bag. Drum must be made vapor tight through the installation of a 7-mil polyethylene interior lining, plus 1½ mil of polyethylene buried in the inside ply of the drum. The full open head of the container must be made vapor tight by the use of a 24-gauge metal lid with a 10-mil preformed sealing disc glued to the rubber gasket cover and locked with a lever type locking ring and pilfer proof seal. The net weight of the dry material shall not exceed 25 pounds.

§ 73.194 Potassium permanganate. (a) Potassium permanganate must be packed in specification containers as follows:

(1) In containers as prescribed in § 73. 154 of this part.

(2) In bulk in sift-proof, self-clearing, covered hopper or bottom outlet steel cars or in sift-proof all steel flat bottom gondola cars with fixed sides and ends equipped with water-proof and dust-proof wooden or steel covers well secured in place for all openings.

§ 73.197a Smokeless powder for small arms. (a) Smokeless powder for small arms in quantities not exceeding 100 pounds net weight transported in one car may be classed as a flammable solid when approved for this classification by the Director of Operation, R.T.C.. Maximum quantity in any inside packaging must not exceed 8 pounds and inside packagings must be arranged and protected to prevent simultaneous ignition of the contents. The complete package must be a type approved by the Director of Operation, R.T.C..

§ 73.198 Sodium hydride. (a) Sodium hydride must be packed in specification containers as follows:

(1) In containers as prescribed in § 73.206 (a) (1) and (a) (2) of this part.

(2) Spec. 17H. Metal drums (single-trip).

(3) Spec. 37A or 37B. Metal drums (single-trip) with welded side seams and hermetically sealed closure or closure made fast by positive pressure of the lid against a rubber gasket with edge of the lid crimped over the lip of the drum and a protective metal ring fastened around the crimped edge, packed in strong outside wooden boxes.

§ 73.199 Rags, oily. Rags, oily, with more than 5 per cent of vegetable or animal oil, must be packed in hermetically sealed metal-lined wooden boxes, or air-tight metal containers.

(b) Rags, oily, as described above, must not be offered for transportation by rail express.

§ 73.200 Rags, wet. (a) Rags, wet, must be packed in hermetically sealed metal-lined wooden boxes, or air-tight metal containers.

(b) Rags, wet, must not be offered for transportation by rail express.

§ 73.201 Rubber scrap, rubber buffings, reclaimed rubber, or regenerated rubber. (a) Rubber scrap, if ground, powdered, or pulverized, and the rubber content of which exceeds 45 per cent, as determined by subtracting the sum of the percentage of ash and the percentage of acetone extract from 100; rubber buffings from any grade of rubber irrespective of the percentage of rubber content; and reclaimed rubber or regenerated rubber, must be packed in specification containers as follows (see paragraph (b) of this section):

(1) Spec. 6B, or 6C. Metal barrels or drums.

(2) Spec. 15A, or 19B. Wooden boxes lined, spec. 2F, or 2M.

(4) Spec. 12B. Fibreboard boxes.

(5) Spec. 21C. Fibre drums. Authorized net weight not over 225 pounds.

(6) Spec. 22A. Wooden drums.

(7) Tank cars tightly and securely closed.

(8) Spec. 36A, 36B, 36C, 44B, or 44E. Bags.

(b) Rubber scrap, reclaimed rubber, or regenerated rubber are not subject to these regulations if shipped in the following forms:

(1) Rubber scrap, not ground or ground with cord or fabric insertion, or ground without cord or fabric insertion other particles of which pass over a screen of not less than 5-mesh.

(2) Reclaimed rubber or regenerated rubber when in the form of dense homogeneous nonporous sheets or rolls, the sheets of thickness of ⅛ inch or greater, packed flat or in rolls, or in pelletized form if not less than ¼ inch in diameter, or ground, the particles of which pass over a screen of not less than 5-mesh, all properly cooled before shipment.

(3) Rubber scrap, reclaimed rubber, or regenerated rubber in any form when shipped in covered steel hopper cars, or tank cars.

§ 73.202 Sodium and potassium, metallic liquid alloy. (a) Sodium and potassium, metallic liquid alloy must be packed in specification containers as follows:

(1) Spec. 15A, 15B or 19B. Wooden boxes with inside metal containers of a type approved by the Director of Operation, R.T.C., cushioned with incombustible cushioning material. Each container must have been tested hydrostatically to a pressure of not less than 60 pounds per square inch. Closing devices must be protected from injury. Not more than 300 pounds of sodium or potassium liquid alloy may be shipped in one outside container.

(2) Spec. 5A, metal barrels or drums not exceeding 400 pounds capacity each, having protruding valves protected by a 12-gauge steel dome securely attached to the head of the drum. Shipments are authorized by rail freight in carload lots only.

(3) Spec. 4BW240 cylinder. Each cylinder must be equipped with steel valve protection caps or collars, or be packed in strong wooden boxes and secured therein to protect the valves.

(4) Spec. 51 portable tank. Tanks shall have a minimum design pressure of 150 pounds per square inch. Safety relief devices must communicate with the vapor space when tanks are fully loaded. Tank must be blanketed with dry nitrogen at all times at a pressure not to exceed 15 p.s.i.g.

(b) Packaging of metallic liquid alloys of sodium or potassium in combination with fissile or large quantities of radioactive material is authorized as provided in § 73.206 (a) (10).

§ 73.203 Tetranitromethane. (a) Tetranitromethane must be packed in specification containers as follows:

(1) Spec. 15A, 15B, or 19B. Wooden boxes, gross weight not exceeding 150 pounds, with inside containers which must be; glass bottles not more than 1 quart capacity each, with closures securely fastened and of a type not deteriorated by the contents, each bottle individually packed in a tight metal container and

cushioned therein with absorbent incombustible material; or aluminum cans or polyethylene bottles, not more than 5 pounds capacity each, with opening not more than 1.25 inches diameter, fitted with securely fastened screw type closures and gaskets of material not deteriorated by contact with the contents, cushioned with not less than 2 inches of absorbent incombustible cushioning material between the inside containers and any part of the wooden box.

(2) Spec. 6B, or 6C. Metal barrels or drums with inside stainless steel or aluminum drum (or drums) having no opening exceeding 2.5 inches diameter, openings to be securely closed by a screw type gasketed device, with gaskets of material not deteriorated by contact with the contents. The inside drum (or drums) must be cushioned with not less than 2 inches of absorbent incombustible cushioning material; inside drums shall be of not less than 20 gauge metal and shall be tested for leakage before packing in the outside drum.

§ 73.204 Sodium dithionite or sodium hydrosulphite. (a) Sodium dithionite or sodium hydrosulphite must be packed in specification containers as follows:

(1)Spec. 11A, 11B, 15A, 15B, 15C, 16A, 19A, or 19B. Wooden barrels, kegs, or boxes with inside glass bottles of capacity not exceeding 5 pounds each, or metal containers.

(2) Spec. 6B, or 6C. Metal barrels or drums.

(3) Spec. 17E, 17H, or 37K. Metal drums (single-trip).

(4) Spec. 37A or 37B. Metal drums (single-trip).

(5) Spec. 21C. Fibre drums with inside metal drums. Authorized net weight not over 225 pounds.

(6) Spec. 21C. Fibre drums. Authorized net weight of product not over 250 pounds; drums must have a metal foil (laminated between two sheets of kraft paper with thermoplastic adhesive) moisture and water barrier wound into the sidewall of the drum and located not more than 2 plies from the interior of drum but not to be wound as the first ply; a metal foil moisture and water barrier must also be present in the fibre or wood heading; exterior of drum sidewall must be protected with a water resistant coating; in addition to the tests prescribed by para. 2 (a), (b) and (c) of Specification 21C, a drum having been given a 4-foot diagonal bottom chime drop must, after being emptied, withstand complete immersion of the bottom in 6 inches of water for 4 hours without leakage to the interior; drums must not be offered for transportation by carriers by water.

(7) Spec. 22B. Plywood drums with inside metal drums.

(8) Spec. 56. Portable tank.

§ 73.205 Sodium picramate, wet. (a) Sodium picramate must be wet with not less than 20 per cent of water by weight and packed in specification containers as follows:

(1) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes with well stoppered glass inside containers of not exceeding 1 quart capacity each, cushioned in the boxes.

(2) Spec. 10A or 10B. Wooden barrels, or kegs.

(3) Spec. 21P. Fibre drum overpack with inside polyethylene container meeting all requirements of Spec. 2U except removable head is authorized. Fibre drum must be rated for a minimum net weight of 600 pounds. maximum gross weight shall not exceed 400 pounds.

§ 73.206 Sodium or potassium metallic, sodium amide, sodium or potassium alloys, lithium metal, lithium silicon, lithium ferro silicon, lithium hydride, lithium aluminum hydride, rubidium metal, zirconium hydride and alkaline earth metal amalgams n.o.s. (a) Sodium or potassium metallic, sodium amide, sodium potassium alloys, lithium metal, lithium silicon, lithium ferro silicon, lithium hydride, lithium aluminum hydride, rubidium metal, zirconium hydride and alkaline earth metal amalgams n.o.s. shall be packed in containers which comply with one of the following specifications:

(1) Spec. 15A, 15B, 19A, or 19B. Wooden boxes with air-tight metal inside containers which must have closing device securely fastened by positive means (not friction). Inside metal cans with closures securely fastened, positive means not required, must not exceed 1-gallon capacity each for lithium aluminum hydride and must be cushioned in outside containers with sufficient incombustible packing material.

(2) Spec. 5, 5C, 6B or 6C. Metal barrels or drums. (Not authorized for lithium aluminum hydride or aluminum hydride).

(3) Specs. 17E, 17H, 37A, or 37B. Metal drums (single-trip). Authorized only for lithium or sodium, which must be fused solid in the container.

(4) Spec. 37A or 37B. Metal drums (single-trip) not exceeding 5 gallons capacity each, with welded side seams and hermetically sealed closure or closure made fast by positive pressure of the lid against a rubber gasket with edge of the lid crimped over the lip of the drum and a protective metal ring fastened around the crimped edge, cushioned on all sides with incombustible packing material, packed in strong outside wooden boxes. Not more than 4 inside metal drums shall be packed in one outside wooden box.

(5) Spec. 17C, metal drums (single-trip). Not authorized for lithium aluminum hydride.

(6) Spec. 17H or 37A. Metal drums (single-trip), with air-tight metal inside containers which must have closing device securely fastened by positive means (not friction). Inside metal containers must be cushioned on all sides by incombustible packing material. Authorized for lithium metal or lithium hydride only.

(7) Spec. 12B. Fibreboard boxes constructed of at least 375-pound test (Mullen or Cady) solid fibreboard with inside airtight metal container which must have a closing device securely fastened by positive means (not friction). Each inside metal container must be individually nested into a double-faced corrugated partition of at least 200-pound test (Mullen or Cady) which is in turn surrounded on all sides by a peripheral double-walled corrugated liner of at least 200-pound test (Mullen or Cady). Authorized gross weight not over 90 pounds.

(8) Spec. 21. Fibre drums constructed for 400 pounds net weight, with the material packed not more than 5 pounds net weight each in not to exceed ½ gallon steel cans equipped with friction-top closures. Authorized for lithium ferro silicon only.

(9) Spec. 12B. Fibreboard boxes with non-sparking inside metal cans securely closed by use of plastic tape, or other efficient means to provide moisture tight seal. Authorized only for lithium metal in ribbon form not over ½ inch wide and 1/16 inch thick. Lithium metal ribbon must be coated with heavy mineral oil or petrolatum and be wound on motion picture film reels not over 1600 foot capacity each.

(10) Tubes of stainless steel, or other metals of equivalent strength and non-reactivity, having sealed, welded end caps, and containing not more than 50 grams of metal. Authorized only for metallic sodium, metallic lithium, metallic potassium, and

sodium potassium alloy. Each tube must be enclosed within a secondary sealed metallic tube and further enclosed within strong tight outer packaging.

(11) Spec. 12B. Fibreboard box. Authorized only for lithium metal in wire form. Fibreboard box must have inside nonsparking metal packaging. Each inside nonsparking metal packaging must be tin coated and sealed by rolled-on lids. The contents of each inside packaging must be coated with heavy mineral oil or petroleum and wound on a 3-inch by 3-inch non-sparking metal spool. The net weight of the contents in each inside packaging must not exceed ¼ pound.

(13) Spec. 21C. Fiber drums with inside hermetically sealed tin-coated steel cans with a minimum wall thickness of 0.015 inch. Not more than four spools made of non-sparking material may be packed in each inside container with not more than 2½ pounds net weight of product in each inside container. Each metal can shall be individually separated with double-faced corrugated partitions and noncombustible packaging material. Authorized only for lithium metal in ribbons.

(b) Sodium or potassium, metallic, sodium amide, and lithium metal, immersed in neutral oil may also be shipped when packed in specification containers as follows:

(1) Spec. 15A, 15B, or 19B. Wooden boxes with inside metal drums, spec. 37A or 37B (single-trip), having welded side seams, net weight not over 30 pounds, or with inside glass containers, each enclosed in a tin container.

(2) Spec. 17H. Metal drum (single-trip). Authorized only for lithium metal in the form of cups or ingots.

(c) Sodium, metallic, may also be shipped when packed in specification containers as follows:

(1) Spec. 105A300-W. Tank cars, having exterior heater coils fusion-welded to tank shell and properly stress-relieved, the material to be in molten condition when loaded into the tank and allowed to solidify before car is offered to the carrier. Outage must be 5 per cent or more of sodium at fusion temperature of 208°F.

(2) Spec. 17C, 17H, 37A, or 37B. Metal drums (single-trip) authorized for cylindrical blocks at least 2 inches in diameter and not less than 6 inches in length, or rectangular blocks not less than 6 inches in length and not less than 2 inches in any other dimension. Net weight not over 300 pounds for spec. 17C drums; not over 30 pounds for spec. 17H, 37A, or 37B drums.

(4) Spec. 51. Portable tanks having a minimum design pressure of 150 psi. Tanks must be equipped with safety valves having a start-to-discharge pressure of 150 psi. Tanks used exclusively in this service are exempt from the terms of paragraph (c) of the specification. If a tank has exterior heating coils such coils must be welded to the tank and must be stress relieved. The material must be in molten condition when loaded and the tank must be held for sufficient time to allow the material to be completely solidified before being offered for transportation. Outage must be 5 per cent or more at a sodium fusion temperature of 208°F.

(d) Lithium or rubidium metal in cartridges, when packed and described as follows is exempt from specification packaging.

(1) In inside hermetically sealed metal cartridges not exceeding 18 grams net weight each, packed in strong outside containers with net weight of lithium metal not exceeding one pound; which outside containers may be overpacked in strong wooden boxes or fibre drums, provided total net weight of lithium or rubidium metal in one outside container does not exceed one pound.

(e) Lithium or rubidium metal in cartridges containing more than 18 grams but not more than 120 grams of lithium, must be packed in specification containers as follows:

(1) Spec. 15A, 15B, 19A, or 19B. Wooden boxes, not over 75 pounds gross weight, with air-tight inside copper cartridges. Cartridges having less than 0.022 inch wall thickness must be separated or securely cushioned in the boxes. Each cartridge must have a minimum thickness of 0.02 inch.

§73.207 Sodium sulphide or potassium sulphide, fused or concentrated, when ground. (a) Sodium sulphide or potassium sulphide, fused for concentrated, when ground, must be packed in specification containers as follows:

(1) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes with inside containers which must be glass bottles enclosed in tightly closed metal cans, or hermetically sealed (soldered) metal cans.

(2) Spec. 6B, or 6C. Metal barrels or drums.

(3) Spec. 12B. Fibreboard boxes, with inside containers which must be hermetically sealed (soldered) metal cans of not over 5 pounds capacity.

(b) When fused or concentrated, but not ground (may be chipped, flaked, or broken), may be shipped in specification containers as follows:

(1) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes with inside bottles of not more than 5 pounds capacity each, or metal cans, with tight covers.

(2) Spec. 12B. Fibreboard boxes with inside containers which must be metal cans of not over 5 pounds net weight each or glass bottles of not over 1 pound net weight each. Packages containing glass or earthenware containers must not weigh over 65 pounds gross.

(3) Spec. 17E, 17H, 37A, or 37B. Metal drums (single-trip).

(4) Spec. 6B, or 6C. Metal barrels or drums.

(5) Spec. 21C. Fibre drums which must be lined or coated, or otherwise treated so as to prevent the entrance of moisture in quantities sufficient to create a hazardous condition in transportation; maximum loaded capacity 250 pounds net.

(6) Spec. 12B. Fibreboard boxes constructed of at least 275-pound test double-faced fibreboard and provided with a perimeter liner and bottom pad of at least 200-pound test fibreboard. Boxes constructed of at least 350-pound fibreboard having top and bottom pads shall not require perimeter liner. Product must be contained within a tightly closed polyethylene or other equally efficient plastic bag constructed of material having minimum thickness of 0.004 inch. Not more than 25 pounds net weight of product may be packed in one outside box.

(7) Spec. 12A. Fibreboard boxes with inside glass bottles not over 5 pounds capacity each. Not more than four bottles having a capacity of 5 pounds each, shall be packed in one outside box. Shipper must have established that completed package meets test requirements prescribed by paragraph 10 of Spec. 12A.

(c) Potassium sulphide, crystallized, is not subject to these regulations.

(d) Sodium sulphide when shipped fused in one solid mass in a metal barrel or drum and sodium sulphide, crystallized, are not subject to these regulations.

(e) Sodium sulphide containing 35 per cent or more combined

water by weight, fused or concentrated but not ground (may be chipped, flaked, or broken), when packed in steel barrels or drums or portable metal tanks that are equipped with moisture-tight closures, or in strong tight fibre drums having a moisture-barrier incorporated in the walls and equipped with moisture-tight closures, is not subject to these regulations. Portable tanks filled to gross weight to be shipped must be capable of withstanding a drop from a height of 4 feet onto solid concrete without rupture or serious damage and must be equipped with lifting devices capable of holding 4 times the gross weight of filled tank.

§ 73.208 Titanium metal powder, wet or dry. (a) Titanium metal powder, wet, with not less than 20 per cent water, must be packed in specification containers as follows:

(1) Spec. 15A, 15B, or 19B. Wooden boxes with inside metal cans not exceeding 1 gallon each, tightly and securely closed, and not more than 12 such inside metal cans in one outside package; or not more than 1 inside metal can of not less than 22-gauge metal and not to exceed 8½ gallons capacity, tightly and securely closed.

(2) Titanium metal powder, wet with not less than 50 percent water by weight, may be packed in any full removable head drum specified in § 73.154.

(b) Titanium metal powder, dry. Titanium metal powder, dry, must be packed in specification containers as follows:

(1) Spec. 15A, 15B, or 19B. Wooden boxes with inside metal containers, tightly and securely closed by push-in covers, held in place by soldering at least four points, or in screw-cap metal cans. Inside containers must not exceed 10 pounds net each. Inside containers must be cushioned by incombustible material such as rock wool or asbestos wool. Gross weight of outside package must not exceed 75 pounds each.

(2) Spec. 17H or 37A. Metal barrels or drums (single-trip) with inside metal drum of not less than 20-gauge metal and with closure secured by positive means. The inside container shall be completely surrounded by not less than 1 inch of incombustible cushioning material.

(3) Spec. 5B. Metal barrels or drums not over 12½ gallons capacity.

(4) Spec. 17C. Metal drums not over 25 gallon capacity.

§ 73.211 Textile waste, wet. (a) Textile waste, wet, must be packed in hermetically sealed metal-lined wooden boxes or air-tight containers.

(b) Textile waste, wet, must not be offered for transportation by rail express.

§ 73.212 Trinitrobenzene and trinitrotoluene, wet. (a) Trinitrobenzene and trinitrotoluene, wet with not less than 10 per cent water, in quantity not exceeding 16 ounces in one outside package, may be shipped as drugs, medicines, or chemicals, when in glass bottles securely stoppered, each bottle enclosed in a strong fibre carton properly cushioned in the outside shipping case and are not subject to any other requirement of these regulations.

§ 73.214 Hafnium metal or zirconium metal, wet, minimum 25 per cent water by weight, mechanically produced, finer than 270 mesh particle size; hafnium metal or zirconium metal, dry, in an atmosphere of inert gas, mechanically produced, finer than 270 mesh particle size; hafnium metal or zirconium metal, wet, minimum 25 per cent water by weight, chemically produced (see Note 1), finer than 20 mesh particle size; hafnium metal or zirconium metal, dry, in an atmosphere of inert gas, chemically produced (see Note 1), finer than 20 mesh particle size.

NOTE 1: Produced by means other than attrition or grinding.

NOTE 2: Any product containing 10 per cent or more, particle size specified, shall be subject to this section.

NOTE 3: Any product containing less than 25 per cent water by weight is considered dry for purposes of these regulations.

(a) Hafnium metal, wet, mechanically produced finer than 270 mesh particle size or chemically produced finer than 20 mesh particle size with a minimum of 25 per cent water by weight (a mixture of water and a suitable antifreeze agent may be used when freezing temperatures may be encountered during transportation) must be packed in specification containers as follows:

(1) Spec. 15A, 15B, or 19B wooden boxes or spec. 6B, or 6C metal drums with inside containers of glass or non-carbon polyethylene having net weight of not over 10 pounds each. Inside glass containers must be equipped with positive type clamp-on closures equipped with rubber gaskets. Inside polyethylene containers may have screw-cap closures equipped with gaskets ahead of thread and shall be of material which will not react with or be decomposed when in contact with contents. Screw-cap closures must be secured in place by suitable tape. Each glass or polyethylene container must be surrounded on all sides with not less than 1 inch of incombustible cushioning material and in an amount sufficient to completely absorb the entire liquid contents of the containers. Each inside glass or polyethylene container must be placed in a spec. 2A metal can closed with push-in cover held in place by soldering or crimping at at least four points. Authorized net weight of hafnium in one outside container shall not exceed 40 pounds for wooden boxes and shall not exceed 150 pounds for steel drums.

(2) Spec. 10A. Wooden kegs containing not more than 75 pounds net each.

(b) Hafnium metal, dry, in an atmosphere of inert gas, mechanically produced finer than 270 mesh particle size or chemically produced finer than 20 mesh particle size must be packed in specification containers as follows:

(1) Spec. 6B or spec. 17C, or 37A (single-trip containers). Metal barrels or drums with inside non-carbon polyethylene bottles having positive type clamp-on closures equipped with rubber gaskets, or with screw-cap closures having not less than three continuous threads and equipped with gaskets ahead of threads, not over 5 pounds net weight capacity each. Screw-cap closures must be secured in place by suitable tape. Each bottle must be placed in a spec. 2R metal container having a wall thickness of ¼ inch and be completely surrounded by cushioning material. Spec. 2R containers must be separated from one another by incombustible cushioning material. Authorized net weight of metal in one outside container not over 150 pounds.

(c) Zirconium metal, wet, mechanically produced finer than 270 mesh particle size or chemically produced finer than 20 mesh particle size with a minimum of 25 per cent water by weight (a mixture of water and a suitable anti-freeze agent may be used when freezing temperatures may be encountered during transportation) must be packed in specification containers as follows:

(1) Spec. 15A, 15B, or 19B wooden boxes or spec. 6B, or 6C or 17C or 17H (single-trip containers) metal drums with inside containers of glass or non-carbon polyethylene having net weight of not over 10 pounds each. Inside glass containers must

be equipped with positive type clamp-on closures equipped with rubber gaskets. Inside polyethylene containers may have screw-cap closures equipped with gaskets ahead of thread and shall be of material which will not react with or be decomposed when in contact with contents. Screw-cap closures must be secured in place by suitable tape. Each glass or polyethylene container must be surrounded on all sides with not less than 1 inch of incombustible cushioning material and in an amount sufficient to completely absorb the entire liquid contents of the containers. Each inside glass or polyethylene container must be placed in a spec. 2A metal can closed with push-in cover held in place by soldering or crimping at at least four points. Authorized net weight of zirconium in one outside container shall not exceed 40 pounds in wooden boxes and 150 pounds in steel drums.

(2) Spec. 10A. Wooden kegs containing not more than 75 pounds net each.

(3) Spec. 37P. Steel drums with polyethylene liner of one-piece molded construction (non-reusable container) not over 5 gallons capacity each. Drums exceeding 1 gallon capacity must be constructed of at least 24-gauge metal.

(4) Spec. 37M. Cylindrical steel overpack with inside spec. 2S container. Each overpack must be constructed of at least 24-gauge steel. Each packaging may not exceed a capacity of 5 gallons. Net weight of contents may not exceed 50 pounds of dry material.

(5) Spec. 6D. Cylindrical steel overpack with inside spec. 2S polyethylene container. Container is limited to single trip only and may not exceed a capacity of 5 gallons. Net weight of contents must not exceed 50 pounds of dry material.

(d) Zirconium metal, dry, in an atmosphere of inert gas, mechanically produced finer than 270 mesh particle size or chemically produced finer than 20 mesh particle size must be packed in specification containers as follows:

(1) Spec. 6B, or 6C or spec. 17C, 17H, or 37A (single-trip containers). Metal barrels or drums with inside non-carbon polyethylene bottles having positive type clamp-on closures equipped with rubber gaskets, or with screw-cap closures having not less than three continuous threads and equipped with gaskets ahead of threads, not over 5 pounds net weight capacity each. Screw-cap closures must be secured in place by suitable tape. Each bottle must be placed in a spec. 2R metal container having a wall thickness of 1/4 inch and be completely surrounded by cushioning material. Spec. 2R containers must be separated from one another by incombustible cushioning materials. Authorized net weight of metal in one outside container not over 150 pounds.

(e) Mechanically produced hafnium metal, coarser than 270 mesh particle size and chemically produced coarser than 20 mesh particle size in strong tight containers are not subject to these regulations.

(f) Mechanically produced zirconium metal, coarser than 270 mesh particle size and chemically produced coarser than 20 mesh particle size in strong tight containers are not subject to these regulations. (See § 73.220, zirconium scrap.)

§ 73.216 Zirconium picramate, wet. (a) Zirconium picramate must be wet with not less than 20 per cent of water by weight and packed in specification containers as follows:

(1) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes with well stoppered glass inside containers of not exceeding 1 quart capacity each, cushioned in the boxes.

(2) Spec. 10A or 10B. Wooden barrels or kegs.

§ 73.217 Calcium hypochlorite, hydrated, calcium hypochlorite mixture, dry, lithium hypochlorite mixture, dry, dichloroisocyanuric acid, dry, dichloroisocyanuric acid salts of potassium and sodium, dry and trichloroisocyanuric acid, dry. (a) calcium hypochlorite, hydrated, calcium hypochlorite mixture, dry, lithium hypochlorite mixture, dry, dichloroisocyanuric acid, dry, dichloroisocyanuric acid salts of potassium and sodium, dry and trichloroisocyanuric acid, dry each containing more than 39 percent available chlorine, must be packed as follows:

(1) Spec. 6B, or 6C. Metal barrels or drums.

(2) Spec. 17E, 17H, 37A, or 37B. Metal drums (single-trip).

(3) Spec. 21C. Fibre drums with inner ply of a laminated sheet of paper and aluminum foil, internally coated with not less than a 0.002 inch thickness of polyethylene. Cover of drum shall be gasketed. Authorized net weight not over 400 pounds.

(4) Spec. 21C. Fibre drums with commodity packed in a securely closed polyethylene bag liner constructed of polyethylene film not less than 0.004 inch thickness. Not authorized for calcium hypochlorite compounds and lithium hypochlorite compounds, dry.

(5) Spec. 21C. Fibre drums with integral inner body ply having 0.010-inch minimum aluminum facing and bottom interior with 0.001-inch minimum aluminum facing. Cover of drum must be gasketed. Authorized net weight not over 400 pounds. Authorized only for calcium hypochlorite compounds, dry.

(6) Spec. 56. Metal portable tanks. Authorized only for dichloroisocyanuric acid salts of potassium and sodium, dry and trichloroisocyanuric acid, dry.

(7) Spec. 35. Non-reusable, removable head polyethylene drum for use without overpack and not over six gallons capacity.

(8) Spec. 12B. Fibreboard boxes with inside polyethylene bottles with a minimum wall thickness of 0.015 inch. Not more than 2 polyethylene bottles may be packed in one box, each bottle containing not more than 16 pounds net weight of commodity. Container must be such that it will not react dangerously with or be decomposed by the commodity.

(9) Spec. 12B. Fibreboard box with not more than two inside minimum 30-gauge steel pails containing not over 26 pounds net weight each. Each cover must be gasketed.

(b) Strong outside wooden or fibreboard packages with inside containers of glass not over five pounds capacity each, or with metal containers or plastic bottles not over ten pounds capacity each, are exempt from specification packaging, when offered for transportation by rail freight or rail express.

§ 73.219 Potassium perchlorate. (a) Potassium perchlorate must be packed as follows:

(1) As prescribed in § 73.154 (a) (1) to (11) and (14). Plastic bottles may be substituted for the inside glass bottles prescribed in § 73.154 (a) (6).

§ 73.220 Magnesium or zirconium scrap consisting of borings, clippings, shavings, sheets, turnings, or scalpings, and magnesium metallic (other than scrap), powdered, pellets, turnings, or ribbon. (a) Magnesium or zirconium scrap consisting of borings, shavings, or turnings, when shipped in carloads, must be packed in closed metal barrels, wooden barrels, metal pails, or four-ply paper bags. In less-than-carload quantities it must be packed in closed metal drums, metal pails, or wooden barrels.

(1) Magnesium or zirconium scrap consisting of clippings, scalpings or scrap sheets may be shipped in bulk in carload or truckload quantities. Cars must be tight box cars or tightly closed steel covered gondola cars and trucks or trailers must have closed or completely covered bodies.

(2) Magnesium or zirconium scrap consisting of clippings, scalpings, or scrap sheets in closed metal drums, wooden barrels, or wooden boxes is exempt from specification packaging requirements.

(b) Magnesium metallic (other than scrap), powdered, pellets, turnings, or ribbon must be packed in containers as prescribed in § 73. 154.

(1) Magnesium metallic (other than scrap), pellets, turnings or ribbon in closed metal drums, metal pails, fibre drums, wooden boxes with inside containers, fibreboard boxes with inside glass bottles not over 1 pound each, with not more than 25 pounds net weight of product in each outside fibreboard box are, unless otherwise provided, exempt from specification packaging requirements.

(2) Spec. 56. Portable tank. For magnesium powder, the following additional requirements must also be met:

(i) The tank must be pressurized with 2 p.s.i.g. of nitrogen before shipment and the pressure relief valve must have a maximum setting of 3 p.s.i.g.,

(ii) The tank must have both a sift-proof valve with a locking pin and a plug or blind flange on the bottom opening.

§ 73.221 Liquid organic peroxides, n.o.s., and liquid organic peroxide solutions, n.o.s. (a) Liquid organic peroxides, n.o.s., and liquid organic peroxide solutions, n.o.s. must be packed in packagings which may be equipped with venting devices wherever necessary to prevent excessive pressure buildup, as follows:

(1) Spec. 1A, 1D, or 1M. Carboys, glass, boxed, capacity not over 5 gallons for spec. 1A, and 5.5 gallons for spec. 1D.

(2) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes with inside containers which must be glass, earthenware, or metal, not over 1 gallon each, cushioned with incombustible packing material in sufficient quantity to absorb the contents of the inner container. Metal inside containers authorized only for materials which will not react dangerously with or be decomposed by contact with metal.

(3) Spec. 12B. Fibreboard box with Specification 2E inside polyethylene bottles, or with glass or metal inside receptacles, not over 1 gallon each. Not more than six 1-gallon polyethylene bottles may be packed in one fibreboard box. Not more than one 1-gallon glass or metal inside receptacle, which must be cushioned with non-combustible packing material in sufficient quantity to absorb the contents of the inner receptacle, may be packed in one fibreboard box. Metal and polyethylene inside receptacles authorized only for material which will not react dangerously with or be decomposed by contact with metal or polyethylene.

(4) Spec. 42B. Aluminum drums not over 12½ gallons capacity. Authorized only for peroxides which will not react dangerously with the aluminum or be decomposed by contact with it.

(5) Spec. 17C or 17E. Metal drums (single-trip) not over 12½ gallons capacity. Authorized only for material which will not react dangerously with the drum metal, or be decomposed by contact with it.

(6) Spec. 22C. Plywood drum as prescribed by subparagraph (2)(a) specification 22C, with inside spec. 2T polyethylene container. Authorized only for material which will not react dangerously with or cause decomposition of the polyethylene.

(7) Spec. 6D or 37M (nonreusable container). Cylindrical steel overpacks with inside spec. 2S polyethylene container. Authorized only for material which will not react dangerously with or cause decomposition of the polyethylene.

(8) Spec. 37P. Steel drums, not over 5-gallons capacity, with one-piece seamless molded polyethylene liner (non-reusable container). Drums exceeding 1-gallon capacity must be constructed of at least 24-gauge metal. Authorized only for materials that will not react with polyethylene and result in container failure.

(9) Spec. 12P. Fibreboard box with one inside spec. 2U polyethylene container of not over 5 gallon capacity, or two inside spec. 2U polyethylene containers of not over 2 gallon capacity each. Wire staples are not authorized for assembly or closure of boxes, except when polyethylene containers are completely enclosed in inside boxes free of wire staples or other projections, that could cause failures.

(10) Spec. 12B. Fibreboard boxes with inside polyethylene bottles, not over 5 gallons capacity each, as specified by Paragraph 34 of Spec. 12B. Not more than one bottle shall be packed in one outside box. Authorized only for material which will not react dangerously with or cause decomposition of polyethylene.

(11) Spec. 16A. Wooden boxes with inside spec. 2U, 2S, or 2SL polyethylene containers, not over 5-gallon capacity each. Spec. 2U container must have a minimum wall thickness of 0.015 inch. The polyethylene container must be separated from the wooden box by a complete corrugated fibreboard liner, top pad, and bottom pad. Authorized only for materials which will not react dangerously with or be decomposed by contact with polyethylene.

(12) Spec. 34. Polyethylene drum. The shipper shall assure conformance with the requirements of § 73.24(e) of this part prior to first shipment.

§ 73.222 Acetyl peroxide and acetyl benzoyl peroxide, solution. (a) Acetyl peroxide must be shipped in solution in a non-volatile solvent and must contain not more than 25 per cent by weight of the peroxide. Acetyl benzoyl peroxide must be shipped in solution in a non-volatile solvent and must contain not more than 40 per cent by weight of the peroxide. They must be packed in specification containers as follows:

(1) Spec. 15A, 15B, 15C, 16A, 19A or 19B. Wooden boxes with inside containers which must be glass or earthenware, not over 1 gallon each, cushioned with incombustible packing material in sufficient quantity to absorb the contents of the inner container.

(2) Spec. 1A or 1D. Carboys, glass, boxed, capacity not over 5 gallons for Spec. 1A, and 5½ gallons for spec. 1D.

(3) Spec. 12B. Fibreboard boxes with inside containers which must be glass or earthenware, not over 1 gallon each, cushioned with incombustible packing material in sufficient quantity to absorb the contents of the inner container. Not more than one 1-gallon inside container shall be packed in one outside fibreboard box.

(4) Spec. 12P. Fibreboard box with one inside spec. 2U polyethylene container of not over 5 gallon capacity, or two inside spec. 2U polyethylene containers of not over 2½ gallon capacity

each. Wire staples are not authorized for assembly or closure of boxes, except when polyethylene container is completely enclosed in inside boxes free of wire staples or other projections that could cause failures.

(5) Spec. 12B. Fibreboard boxes with inside polyethylene bottles, not over 5 gallons capacity each, as specified by para. 34 of Specification 12B. Not more than one bottle shall be packed in one outside box. Authorized only for material which will not react dangerously with or cause decomposition of polyethylene.

(6) Spec. 34. Polyethylene drum. The shipper shall assure conformance with the requirements of § 73.24(e) of this part prior to first shipment.

§ 73.223 Peracetic acid. (a) Peracetic acid must be shipped in solution not exceeding 40 per cent strength and must be packed in specification containers as follows:

(1) Spec. 15A, 15B, 15C, 16A, or 19A. Wooden boxes with inside containers which must be glass or earthenware, not over one gallon capacity each, cushioned with sterile absorbent cotton or other cushioning material which will not react with the contents to generate heat. Cushioning material must be in sufficient quantity to completely absorb the contents of the inner container.

(2) Spec. 12B. Fibreboard boxes with inside containers which must be glass or earthenware, not over one quart capacity each, cushioned with sterile absorbent cotton or other cushioning material which will not react with the contents to generate heat. Cushioning material must be in sufficient quantity to completely absorb the contents of the inner container.

(3) Spec. 1D. Boxed glass carboy.

(4) Spec. 22C. Plywood drum as prescribed by subparagraph (2)(a) specification 22C with inside spec. 2T polyethylene container.

(5) Spec. 37M. Cylindrical steel overpack (nonreusable container) with inside spec. 2SL polyethylene container not over 25 gallons capacity. Polyethylene container must have a vented closure capable of preventing leakage of liquid contents.

(6) Spec. 21P. Fibre drum overpack with inside spec. 2SL polyethylene container not over 25 gallon capacity. Container must have a vented closure to prevent accumulation of internal pressure.

(7) Spec. 34. Polyethylene drum. The shipper shall assure conformance with the requirements of § 73.24(e) of this part prior to first shipment.

(b) Peracetic acid solutions not exceeding 40 per cent strength packed in strong wooden or fibreboard boxes, with not more than one inside glass container not exceeding 1 pint or 1 pound capacity, cushioned with sterile absorbent cotton or other cushioning material which will not react with the contents to generate heat, and with such cushioning material in sufficient quantity to completely absorb the contents of the bottle are exempt from specification packaging requirements.

§ 73.224 Cumene hydroperoxide, dicumyl peroxide, diisopropylbenzene hydroperoxide, paramenthane hydroperoxide, and pinane hydroperoxide. Cumene hydroperoxide of strength not exceeding 96 per cent in a non-volatile solvent, dicumyl peroxide of strength not exceeding 50 per cent in a non-volatile solvent, diisopropylbenzene hydroperoxide of strength not exceeding 60 per cent in a non-volatile solvent, paramenthane hydroperoxide of strength not exceeding 60 per cent in a non-volatile solvent, and pinane hydroperoxide must be packed in specification containers as follows:

(1) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes with inside containers which must be glass or earthenware, not over 1 gallon each, cushioned with incombustible packing material in sufficient quantity to absorb the contents of the inner container.

(2) Spec. 17E. Metal drums (single-trip), with interiors so treated that they will be resistant to the contents.

(3) Spec. 103, 103W, 103A, 103AW, 111A100W1, or 111A100W2. Tank cars. Authorized for 90 per cent or less cumene hydroperoxide in a non-volatile solvent, paramenthane hydroperoxide of strength not exceeding 60 per cent in a non-volatile solvent and in the diisopropyl benzene hydroperoxide of a strength not exceeding 60 per cent in a non-volatile solvent only. Spec. 103, 103W, and 111A100W1 tank cars must have bottom outlet effectively sealed from the inside.

§ 73.225 Phosphorus sesquisulphide, phosphorus pentasulphide, phosphorus heptasulphide, and phosphorus trisulphide. (a) Phosphorus sesquisulphide, phosphorus heptasulphide, and phosphorus trisulphide shall be packed in containers which meet one of the following specifications:

(1) Spec. 15A, 15B, or 19B. Wooden boxes with metal inside containers hermetically sealed (soldered) or water-tight metal cans with screw-top closures. Other closures if approved by the Director of Operation, R.T.C. will be permitted.

(2) Spec. 6B, or 6C. Metal barrels or drums, not over 25 gallon capacity each.

(3) Spec. 37A or 37B. Metal drums (single-trip). Gross weight not over 425 pounds.

(b) Phosphorus pentasulphide must be packed as follows:

(1) In any packaging prescribed in § 73.154 which will not permit water to come in contact with the lading.

(2) Spec. 53 or 56. Metal portable tank.

(3) Metal drum not over 12 gallons capacity. Authorized only for phosphorus pentasulphide fused into a solid mass before transportation.

§ 73.226 (Cancelled).

§ 73.227 Urea hydrogen peroxide. (a) Urea hydrogen peroxide must be packed in specification containers as follows:

(1) Spec. 12B. Fibreboard boxes with inside containers which must be rubber or plastic containers not exceeding 4 ounces each. Gross weight not over 65 pounds.

(2) Spec. 21C. Fibre drums completely coated on the inside with a suitable wax, synthetic coating, or metal foil suitable to the lading; or fibre drums having a metal foil (laminated between two sheets of Kraft paper with thermoplastic adhesive) moisture and water barrier wound into the sidewall of the drum and located not more than 2 plies from the interior of drum but not to be wound as the first ply; a metal foil moisture and water barrier must also be present in the fibre or wood heading; exterior of drum sidewall must be protected with a water resistant coating; in addition to the tests prescribed by Spec. 21C para. 2(a), (b), and (c), a drum having been given a 4-foot diagonal bottom chime drop must, after being emptied, withstand complete immersion of the bottom in 6 inches of water for 4 hours without leakage to the interior. Authorized net weight not over 225 pounds.

(3) Spec. 22A. Plywood drums with paper bags, spec. 2J coated with suitable wax on the inner surface.

§ 73.228 Zinc ammonium nitrite. (a) Zinc ammonium nitrite must be packed in specification containers as follows:

(1) Spec. 6B, or 6C. Metal barrels or drums.

(2) Spec. 17E, 17H, 37A, or 37B. Metal drums (single-trip). Gross weight not over 300 pounds.

§ 73.229 Chlorate and borate mixture or chlorate and magnesium chloride mixtures. (a) Chlorate and borate mixtures or chlorate and magnesium chloride mixtures containing more than 50 per cent chlorate and no other hazardous additives must be packed as follows:

(1) As prescribed in § 73.163.

(b) Chlorate and borate mixtures or chlorate and magnesium chloride mixtures containing no other hazardous additives and containing less than 50 per cent chlorate are exempt from specification packaging requirements when offered for transportation by rail freight and packed as follows:

(1) Tight metal or fibre drums.

(2) Wooden boxes with tight inside metal containers.

(3) Multi-wall paper bags, net weight not over 50 pounds, moisture proof and sift proof, and having a strength capable of withstanding four 4-foot drops onto solid concrete.

(4) Strong fibreboard boxes with inside fibre containers having metal tops and bottoms net weight not over 4 pounds each; gross weight of completed package not over 65 pounds.

(5) Strong fibreboard boxes with not more than 4 inside paper bags spec. 2D, having net weight not over 10 pounds each.

(c) Chlorate and borate mixtures or chlorate and magnesium chloride mixtures containing 28 per cent or less chlorate and no other hazardous additives, are not subject to these regulations.

§ 73.230 Sodium, metallic, dispersion in organic solvent. (a) Sodium, metallic, dispersion in organic solvent must be packed in specification containers as follows:

(1) Spec. 15A, or 19B. Wooden boxes with inside containers which must be metal cans not exceeding one quart capacity, and each such can must be packed in another metal can and cushioned on all sides with at least one inch of incombustible dry nonhygroscopic material which is nonreactive with sodium at temperatures encountered during normal transportation. Both the inner and outer metal cans shall be equipped with an airtight closing device secured by positive means (not friction). Gross weight of completed package must not exceed 100 pounds.

(2) Spec. 17H. metal drum (single-trip) of not over 46 gallons capacity, with material contained in an inside spec. 17E metal drum (single trip) of not over 25 gallons capacity. The inside drum shall be snugly packed in the outside drum by completely and evenly surrounding it with incombustible dry nonhygroscopic material which is non-reactive with sodium at temperatures encountered during normal transportation.

(3) Spec. 12B. Fibreboard boxes constructed of at least 375-pound test (Mullen or Cady) solid fibreboard with inside metal cans not exceeding one quart capacity. Each such can must be packed in another metal can and cushioned on all sides with at least one inch of incombustible dry nonhygroscopic material which is nonreactive with sodium at temperatures encountered in normal transportation. Both the inner and outer metal cans shall be equipped with an airtight closing device secured by positive means (not friction) and must be individually nested into a double faced corrugated partition of at least 200-pound test (Mullen or Cady) which is in turn surrounded on all sides by a peripheral double-walled corrugated liner of at least 200-pound test (Mullen or Cady). Authorized gross weight not over 90 pounds.

(4) Spec. 15A, or 19B. Wooden boxes with inside polyethylene bottles not exceeding one quart capacity each cushioned on all sides with at least one inch soda ash and then placed within an air-tight metal can closed by a positive means. Metal cans shall be cushioned so as to prevent movement within the outer box. Solvents used must be compatible with the inner polyethylene bottle. Gross weight of the completed package must not exceed 100 pounds.

§ 73.231 Calcium, metallic, crystalline. (a) Calcium, metallic, crystalline must be packed in specification containers as follows:

(1) Spec. 15A, 15B, or 19B. Wooden boxes with airtight inside metal containers not over 1 gallon capacity each.

(2) Spec. 6B, or 6C. Metal barrels or drums, gross weight not over 350 pounds.

(3) Spec. 17C or 17H. Metal drums (single-trip), gross weight not over 350 pounds.

§ 73.232 Tank cars containing residual phosphorus. (a) Tank cars from which phosphorus has been unloaded and from which all residual phosphorus has not been removed by thorough cleaning must be shipped filled with water or an inert gas.

§ 73.233 Nickel catalyst, finely divided, activated or spent. (a) Nickel catalyst, finely divided, activated or spent must be wet with not less than 40 per cent by weight of water or other equally suitable liquid and must be packed in specification containers as follows:

(1) Spec. 15A, 15B, or 19B. Wooden boxes with airtight metal inside containers which must have closing device fastened by positive means (not friction); or airtight glass inside containers of not over 1 quart capacity each, securely cushioned in asbestos wool, vermiculite, or equally efficient incombustible cushioning material.

(2) Spec. 12B. Fibreboard boxes with airtight metal inside containers which must have closing device fastened by positive means (not friction); or airtight glass inside containers of not over 1 quart capacity each, securely cushioned in asbestos wool, vermiculite, or equally efficient imcombustible cushioning material.

(3) Spec. 5, 6B, or 6C. Metal barrels or drums not over 46 gallons capacity each.

(4) Spec. 17H, 37A, or 37B. Metal drums (single-trip).

§ 73.234 Sodium nitrite and sodium nitrite mixtures. (a) Sodium nitrite and sodium nitrite mixtures must be packed in specification containers as follows:

(1) In containers as prescribed in § 73.154.

(2) Spec. 44C. Multiwall paper bags. Each bag must be constructed as follows and, in addition, each bag must have one inner ply bonded or coated with polyethylene or other suitable pliable plastic material having a minimum basis weight of 10 pounds, or an additional polyethylene inner ply (free film) of equivalent moisture barrier properties:

(i) At least 5 plies having a minimum total basis weight of 310 pounds, or at least 4 plies of extensible Kraft paper having a minimum basis weight of 240 pounds. Maximum authorized net weight is 100 pounds; or

(ii) At least 3 plies of extensible Kraft paper having a minimum basis weight of 180 pounds. Maximum authorized net weight is 50 pounds.

(3) Spec. 21C. Fibre drums. Authorized net weight not over 400 pounds.

(4) Spec. 37A. Metal drums constructed of steel having a minimum thickness of 24 gauge. Bolted or lever-lock closure rings authorized provided drums withstand test prescribed by paragraph 11 of Spec. 37A. Authorized gross weight not over 425 pounds.

(5) Sodium nitrite is authorized for shipment in tight sift-proof covered hopper cars. Cars must be thoroughly cleaned before loading.

(6) Tank cars which must be thoroughly cleaned before loading.

§ 73.235 Ammonium bichromate (ammonium dichromate). (a) Ammonium bichromate (ammonium dichromate) must be packed in specification containers as follows:'

(1) In containers as prescribed in § 73.154.

(2) Spec. 21C. Fibre drums. Authorized net weight not over 400 pounds.

§ 73.236 Decaborane. (a) Decaborane must be packed in specification containers as follows:

(1) Spec. 6B, or 6C. Metal barrels or drums.

(2) Spec. 17C, 17E, 17H, 37A, or 37B. Metal drums (single-trip).

(3) Spec. 12B. Fibreboard boxes with inside containers which must be metal cans; sliding-lid wooden boxes; fibre cans or boxes, spec. 2G, not over 5 pounds capacity each; or glass bottles not over 1 pound capacity each. Packages containing glass containers must not weigh over 65 pounds gross.

§ 73.238 Aircraft rocket engines (commercial) and/or aircraft rocket engine igniters (commercial). (a) Aircraft rocket engines (commercial) and/or their igniters may be offered for transportation by rail freight or rail express when of a type approved by the Director of Operation, R.T.C. and when packaged and packed as follows:

(1)Spec. 15A, 15B, 15E, 16A, or 19B. Wooden boxes. Igniters must be packaged in sealed metal containers approved by the Director of Operation, R.T.C. and packed in wooden boxes as specified above when shipped separately from the Aircraft rocket engines.

(2) Aircraft rocket engines (commercial), when approved by the Director of Operation, R.T.C., may be packed in the same outside shipping container with their separately packaged igniters. Igniters must be packed in separate sealed metal containers in strong inside containers.

(3) Aircraft rocket engines (commercial) and/or their igniters packed in any other manner than specified in subparagraphs (1) and (2) of this paragraph, must be in containers of a type approved by the Director of Operation, R.T.C..

NOTE 1: For purposes of § 73.238, aircraft rocket engines (commercial) are standby aircraft propulsion engines which are for civil aircraft installation only, comprising a metal case containing a solid composite fuel other than one classified as an explosive and containing no explosive material or element.

§ 73.239 Barium azide—50 per cent or more water wet. (a) Barium azide—50 per cent or more water wet, must be packed in specification containers as follows:

(1) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes with inside glass bottles not over one pound capacity each. Bottles shall have rubber stoppers wire tied for securement. If shipment is to take place at a time freezing weather is to be anticipated, a suitable anti-freeze solution must be used to prevent freezing

(2) Spec. 21C. Fibre drum with inside glass bottle not over 1-pound capacity each. Bottles must have rubber stoppers wire-tied for securement. If shipment is to take place at a time freezing weather is anticipated, a suitable antifreeze solution must be used to prevent freezing.

§ 73.239a Ammonium perchlorate. (a) Ammonium perchlorate must be packed in specification containers as follows:

(1) In containers as prescribed in § 73.154.

(2) Spec. 53 or 56. Metal portable tank. Lower side or hopper-type product discharge openings are not permitted.

SUBPART E—CORROSIVES

§ 73.241 Outage. (a) Outage for containers of corrosive liquids for transportation by carriers by rail freight, or rail express must be as follows:

(1) The proper vacant space (outage) in a tank car or other shipping container depends on the coefficient of expansion of the liquid and the maximum increase of temperature to which it will be subjected in transit. Outage must be calculated to the total capacity of the container.

(2) Outage requirements for containers other than tank cars, and portable tanks. Containers must not be entirely filled. Sufficient interior space must be left vacant to prevent leakage or distortion of containers due to the expansion of the contents from increase of temperature during transit.

(3) Outage requirements for tank cars. In tank cars, outage must be calculated to percentage of the total capacity of the tank, i.e., shell and dome capacity combined. If the dome of the tank cars does not provide sufficient outage, then vacant space must be left in the shell to make up the required outage. The outage for tank cars must not be less than 2 percent, except that outage for Specification 103A, 103B, 103C, 103E, 103A-AL, 103C-AL, 103AW, 103BW, 103CW. 103EW, 103ANW, 103A-ALW tank cars must not be less than 1 per cent.

(4) Outage requirements for portable tanks. No portable tank, or compartment thereof, used for the transportation of any corrosive liquid shall be completely filled. The outage for portable tanks must be no less than 2 per cent.

§ 73.242 Bottles containing corrosive liquids. (a) Bottles containing corrosive liquids may not be packed in the same outside container with any other article, except as specifically provided in paragraphs (b) and (c) of this section and § § 73.257, 73.258, 73.259, 73.260, 73.261, or 73.286.

(b) Bottles containing corrosive liquids cushioned by incombustible absorbent material and securely packed in tightly closed metal containers, except hydrofluoric acid which must be packed in a container other than a metal container, may be packed with other articles. This exception does not apply to

nitric acid exceeding 40 per cent concentration, perchloric acid, hydrogen peroxide exceeding 52 per cent strength by weight, nitrohydrochloric acid, or nitrohydrochloric acid diluted, which must not be packed in the same outside container with any other article under any circumstances.

(c) Corrosive liquid solutions in securely closed bottles, in quantities necessary for preparing photographic processing mixtures and efficiently cushioned, may be packed in the same outside shipping container with required amounts of packaged dry chemicals not classed as dangerous commodities by these regulations, provided no dangerous reaction would occur should the contents of bottles be mixed with the dry chemicals.

§ 73.243 Closing and cushioning. (a) All containers must be tightly and securely closed. Inside containers must be cushioned as prescribed or in any case when necessary to prevent breakage or leakage.

§ 73.244 Exemptions for corrosive materials. (a) Corrosive materials, except those for which no exemptions are provided as indicated by the "No exemption" statement in § 72.5 of this chapter, are exempt from specification packaging requirements of this part when packed as follows:

(1) Corrosive liquids, in bottles having a rated capacity not over 16 ounces by volume each enclosed in a metal can packed in strong outside packaging.

(2) Corrosive liquids, in metal or plastic containers having a rated capacity not over 16 ounces by volume in strong outside packaging.

(3) Corrosive liquids, in glass containers having a rated capacity not over 8 fluid ounces by volume in strong outside packaging and cushioned with sufficient absorbent material to completely absorb the liquid contents in the event of breakage, and which will not react chemically with the corrosive material.

(4) Corrosive solids, in earthenware, glass, plastic, or paper containers of not more than 5 pounds capacity each packed in metal, wooden or fibreboard outside packaging not exceeding 25 pounds net weight each.

(5) Corrosive solids, in metal, rigid fiber or composition cans or cartons or rigid plastic containers, of not more than 10 pounds capacity each, over-packed in metal, wooden or fibreboard outside containers not exceeding 25 pounds net weight each.

§ 73.245 Corrosive liquids not specifically provided for. (a) Corrosive liquids other than those for which special requirements are prescribed, must be packed in specification containers constructed of materials that will not react dangerously with or be decomposed by the chemical packed therein, as follows:

(1) Spec. 1A. Glass carboys in boxes.

(2) Spec. IX. Boxed carboys; single-trip for export only, are authorized to be transported to ship side by rail freight in carload lots only.

(3) Spec. 1D. Glass carboys in boxes. Pressure in the carboy may not exceed 10 pounds per square inch at 130°F. (55°C.). If the package is vented, there may be no significant release of content to the environment.

(4) Spec. 5A, 5B, 5C, or 5M. Metal barrels or drums.

(6) Spec. 11A or 11B. Wooden barrels or kegs with inside containers which must be glass or earthenware, not over 2 gallons each.

(7) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes with inside containers which must be glass, earthenware, polyethylene or other non-fragile plastic material (bags are not authorized), not over 1 gallon each, except that inside containers up to 3 gallons are authorized when only one is packed in each outside container.

(12) Spec. 12B. Fibreboard boxes with inside containers of polyethylene, or other non-fragile plastic material resistant to the lading, and having threaded closures or other equally efficient type closure, not over 1 gallon capacity each, suitably cushioned to prevent movement within the box. Gross weight of complete package must not exceed 65 pounds.

(13) Spec. 15P or 22C. Glued plywood or wooden box, or plywood drum as prescribed by subparagraph 2(a) specification 22C with spec. 2T polyethylene container.

(14) Spec. 17C, 17E, or 17F. Metal drums (single-trip) with openings not exceeding 2.3 inches in diameter.

(15) Spec. 17H. Metal drums (single-trip). Authorized for viscous cleaning compounds, liquid, only.

(16) Spec. 6D or 37M (nonreusable container). Cylindrical steel overpacks with inside spec. 2S or 2SL polyethylene container.

(17) Spec. 17H, 37A or 37B, metal drums (single-trip), with welded side seams, not over 5 gallons capacity each. Drums must be lined throughout with a pliable plastic material impervious to the lading. Spec. 37A and 37B metal drums must be at least 24 gauge steel.

(18) Spec. 12A. Fibreboard boxes with inside glass, polyethylene, or other non-fragile plastic bottles not over 1-gallon capacity each. Not more than 4 inside glass bottle exceeding 5 pints capacity each shall be packed in the outside container. Shipper must have established that the completed package meets test requirements prescribed by paragraph 10 of Spec. 12A.

(19) Spec. 37P. Steel drums with polyethylene liner (non-reusable container). Authorized only for materials that will not react with polyethylene and result in container failure.

(20) Spec. 16D. Wirebound wooden overwrap, with inside spec. 2T, 2TL, 2S, or 2SL polyethylene container.

(21) Spec. 12P. Fibreboard box with one inside spec. 2U polyethylene container of not over 5-gallon capacity, or two inside spec. 2U polyethylene containers of not over 2½ gallon capacity each. Wire staples are not authorized for assembly or closure of boxes, except when polyethylene container is completely enclosed in inside boxes free of wire staples, or other projections, that could cause failures.

(22) Spec. 16A. Wirebound wooden box (see paragraph 22 specification 16A) with inside specification 2U polyethylene container. The polyethylene container shall be separated from the wooden box by a complete corrugated fibreboard liner and top and bottom pads.

(23) Spec. 12B. Fibreboard boxes with inside polyethylene bottles, not over 5 gallons capacity each, as specified by paragraph 34 of specification 12B. Not more than one bottle shall be packed in one outside box.

(24) Spec. 21P. Fibre drum overpack with inside spec. 2S, 2SL, or 2U, polyethylene container.

(25) Spec. 12A or 12B. Fibreboard boxes with inside aluminum containers not over 5 pounds capacity each. Aluminum

containers must be approved by the Director of Operation, R.T.C..

(26) Spec. 34. Polyethylene drum. The shipper shall assure conformance with the requirements of § 73.24(e) of this part prior to first shipment.

(27) Spec. 33A. Polystyrene case (nonreusable container) with inside glass bottles not over 5 pint capacity each. Not more than four 5-pint bottles may be packed in one outside packaging.

(28) Specification steel or nickel cylinders prescribed for any compressed gas except acetylene are authorized. All cylinder valves must be protected by one of the methods described in § 73.301(g)(1), (2), or (3). See § 73.34(e)(16).

(32) Spec. 103AW, 103A-ALW, 103ANW, 103BW, 103CW, 103EW, 105A100W, 105A200ALW, 109A200ALW, 111A100F2, 111A60ALW2, 111A60W2, 111A60W5, or AAR201A80W. Tank cars. Spec. 105A200ALW tank cars authorized only for acetic anhydride and ammonia solution. Spec. 105A100W, AAR201A80W and 109A200ALW tank cars authorized only for ammonia solution.

(33) Spec. 103ALW, 103DW, 103W, 104W, 111A60ALW1, 111A60W1, 111A100W3, 111A100W6, 115A60W6, or AAR206W. Tank cars. Authorized only on an interim basis pending the Commission's decision on use of bottom outlets for tank cars containing dangerous goods.

(34) Spec. 42B. Aluminum drum.

(38) spec. 57. Steel portable tank. Authorized only for acetic acid, glacial; acetic acid solutions; cleaning compound liquid; lacquer, paint or varnish removing compound, liquid; and phosphoric acid not exceeding 85 percent strength. For acid solutions, tanks constructed of a steel other than stainless steel must have a polyethylene liner impervious to the solution.

§ 73.245a Corrosive liquids, n.o.s. shipped in bulk. (a) Corrosive liquids, n.o.s., may not be shipped in bulk in tank cars, or portable tanks except as follows:

Corrosive-liquid	Authorized tank car	Authorized portable tank[1]
Dichlorobutene and Dichlorobutene mixtures	105A300W 112A340W	....
Vanadium oxytrichloride and Titanium tetrachloride mixture	.....	51, monel or monel-clad,
Ethyl chlorothiolformate.	.....	51, monel-clad.
Ethyl phosphorothioic dichloride, anhydrous.	103AW	51.
Ethyl phosphorous dichloride, anhydrous.	.....	51.
Ethyl phosphorodichloridate.	103ANW, 103AW, 111A100F2, 111A100W2[2].	.....
Methyl phosphorothioic, dichloride, anhydrous.	103AW	51.
Methyl phosphorous dichloride[1].	.....	51.

[1] In an unlined tank, must be loaded and shipped under a blanket of non-flammable, dry, inert gas, adequate to displace any significant amount of air.

[2] Specification 103ANW tank car must be solid nickel at least 95 percent pure; all cast metal parts of the tank in contact with the lading must have a minimum nickel content of approximately 96.7 percent. Specification 103A tank car tank must be lead-lined steel or must be made of steel at least 10 per cent nickel clad; specification 103AW, 111A100F2, or 111A100W2 tank must be lead-lined steel or made of steel with a minimum thickness of nickel cladding 1/16 inch nickel cladding in tanks must have a minimum nickel content at least 99 percent pure nickel.

[1] Tank must be equipped with a safety-relief valve set at not less than 100 psig. In addition, the relief valve must comply with § 73.315 (i)(1).

(b) Corrosive liquids, n.o.s., other than those listed in paragraph (a) of this section, when shipped in bulk must be packaged as prescribed by § 73.245.

§ 73.245b Corrosive solids not specifically provided for. (a) corrosive solids, other than those for which special requirements are prescribed, must be packaged in containers fully complying with § 73.24, as follows:

(1) Metal, wooden, or fibreboard box or case with inside containers which must be earthenware, glass, metal, plastic, or fibre or composition board of not more than 10 pounds net weight capacity each.

(2) Fibreboard box with inside paper bags of not over 50 pounds net weight capacity.

(3) Fibreboard box with one inside plastic bag of not over 120 pounds net weight capacity.

(4) Metal drum not over 45-gallon capacity.

(5) Fibre drum not exceeding 550 pounds net weight and not over 55-gallon capacity.

(6) Open head plastic drum or pail not exceeding 95 pounds net weight and not over 6-gallon capacity or closed head plastic drum not exceeding 550 pounds net weight and not over 46-gallon capacity.

(7) Bag: Each bag filled to weight with product and closed as for shipment must be capable of withstanding four drops from a height of 4 feet onto a solid surface, one drop on each end and one drop on each face, without sifting or rupture. Authorized net weight not to exceed 110 pounds.

(8) Metal portable tank or closed bin not over 7,000 pounds gross weight.

(9) Fibreglass or rubber tank or closed bin of not over 74-cubic-foot capacity.

(10) Metal, sift-proof tank cars, or hopper-type cars approved by the Director of Operation, R.T.C..

§ 73.246 Antimony pentafluoride, iodine pentafluoride, bromine pentafluoride, bromine trifluoride, and chlorine trifluoride

(a) Antimony pentafluoride, iodine pentafluoride, bromine pentafluoride, bromine trifluoride, and chlorine trifluoride shall be commercially anhydrous and shall be packed in containers which comply with one of the following specifications:

(1) Spec. 3A150, 3AA150, 4B240, 3B240, 3BN150, 4BW240, 3E1800 or 4BA240 Cylinders closed by means of iron or steel threaded plugs, or

(2) Spec. 106A500X or 110A500W tanks (authorized for iodine pentafluoride and chlorine trifluoride only). Each tank shall be equipped with a valve protection cover and with solid steel plugs in place of fusible plug safety devices. No tank shall be equipped with a safety relief valve.

§ 73.247 Acetyl bromide, acetyl chloride, antimony pentachloride, benzoyl chloride, boron trifluoride-acetic acid complex, chromium oxychloride, dichloroacetyl chloride, pyrosulphuryl chloride, silicon tetra chloride, sulphur chloride (mono and di), sulphuryl chloride, thionyl chloride, stannic chloride (anhydrous), titanium tetrachloride, acetyl iodide and trimethyl acetyl chloride. (a) Materials cited in the heading of this section shall be packed in specification containers as follows:

(1) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes with glass or earthenware inside containers not over 1 gallon each, except that inside containers up to 3 gallons each are au-

thorized when only one is packed in an outside container.

(2) Spec. 11A or 11B. Wooden barrels or kegs, with glass or earthenware inside containers not over 2 gallons each.

(3) Spec. 1A, 1D, or 1K. Glass carboys in boxes (not permitted for antimony pentachloride or titanium tetrachloride, anhydrous).

(4) Spec. 1X. Boxed carboys single-trip for export only. Shipments are authorized to be transported to ship side by rail freight in carload lots only (not permitted for antimony pentachloride or stannic chloride (anhydrous).

(5) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes with aluminum bottles of 99 per cent pure aluminum not over 1 gallon capacity each, having aluminum screw caps with gasket resistant to contents. Authorized for chromium oxychloride only.

(6) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes having inside containers of securely closed soft-lead tubes having not more than 65 fluid ounces capacity each, which tubes shall be individually packed in securely closed steel tubes, with not more than 3 such steel tubes fastened together as a unit. The inside units shall be surrounded on all sides with incombustible mineral material. Authorized for titanium tetrachloride only.

(7) Spec. 5, 5A, 5B, or 17C. Metal barrels or drums with openings not exceeding 2.3 inches in diameter.

(8) Spec. 5K. Nickel drums, authorized for acetyl chloride, benzoyl chloride, pyro sulphuryl chloride, sulphuryl chloride and thionyl chloride only. When shipped in unstabilized condition, the lading must be anhydrous and must be free from impurities such as iron.

(9) Spec. 5C. Barrels or drums of type 304 stainless steel not over 25 gallon capacity each. Authorized for chromium oxychloride and thionyl chloride only.

(10) Spec. 42D. Aluminum drums not over 25 gallon capacity each. Authorized for chromium oxychloride only.

(11) Spec. 60. Portable tanks.

(13) Spec. 103A[1], 103AW, 105A300W, 111A100F2, or 111A60W2 tank cars, except that for stannic chloride (anhydrous) spec. 105A300-W tank cars must be used.

(14) Spec. 103A[1], 103AW, 111A100F2, or 111A60W2 tank cars. Authorized for titanium tetrachloride, anhydrous only. Tank cars shall have safety valves of approved design and not subject to rapid deterioration by the lading.

(15) Sulphur chloride packed in glass or earthenware bottles or carboys must be cushioned in the outside container by means of incombustible elastic packing material of such nature that a mixture of the liquid and the packing material will not cause fires or heating.

(16) Spec. 106A500X or 110A500W tanks. Authorized for antimony pentachloride and titanium tetrachloride (anhydrous) only. Tanks containing titanium tetrachloride (anhydrous) must not be equipped with safety devices. Authorized for transportation by rail freight. See § 74.560 for special requirements.

(17) Spec. 4BA240 or 4BW240. Metal cylinder. Authorized only for titanium tetrachloride or stannic chloride anhydrous, without any compressed gas. Spec. 4BW carbon steel cylinders authorized for antimony pentachloride. Cylinders with safety relief devices are authorized only for titanium tetrachloride.

(18) Spec. 3E1800. Cylinder authorized only for thionyl chloride, anhydrous, and titanium tetrachloride, anhydrous.

(19) Spec. 51. Portable tank authorized only for titanium tetrachloride, anhydrous, without any compressed gas.

§ 73.247a Vanadium tetrachloride and vanadium oxytrichloride. (a) Vanadium tetrachloride and vanadium oxytrichloride must be packed in specification packaging as follows:

(1) Spec. 3A, 3AA, 4B240, 4BA240, 4BW240, or 3E1800 Cylinders.

(2) Spec. 51. Portable tanks.

§ 73.248 Sludge acid, spent sulphuric acid, or spent mixed acid. (a) Sludge acid, spent sulphuric acid, or spent mixed acid, resulting from the use of sulphuric acid in various processes, except when containing hydrofluoric acid, which will not corrode interior of tank cars at sufficiently rapid rate to cause leakage during transportation, must be packed in specification containers as follows:

(1) Spec. 1A or 1D. Carboys in boxes. Authorized for spent sulphuric acid only.

(2) Spec. 1X. Boxed carboys of single-trip for export only are authorized to be transported to ship side by rail freight in carload lots only.

(3) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes with inside containers which must be glass or earthenware, not over 1 gallon each, except that inside containers up to 3 gallons are authorized when only one is packed in each outside container.

(4) Spec. 103A[1], 103AW, 111A100F2, or 111A60W2. Tank cars, provided the product is sufficiently liquid to be unloaded through the dome or manway. Tanks which do not contain products or contaminants that give off noxious or flammable vapours may be equipped with safety vent incorporating lead discs having a 1/8-inch breather hole in the centre thereof.

(5) Spec. 103[1], 103W, 111A60F1, or 111A60W1. Tank cars, provided the product is too viscous to be unloaded through the dome or manway. Tanks which do not contain products or contaminants that give off noxious or flammable vapours may be equipped with safety vents incorporating lead discs having 1/8-inch breather hole in the centre thereof.

(7) Spec. 60. Portable tanks.

§ 73.249 Alkaline corrosive liquids, n.o.s., alkaline caustic liquids, n.o.s., alkaline corrosive battery fluids, potassium hydrogen fluoride solution, sodium hydroxide solution, potassium hydroxide solution and sodium aluminate, liquid. (a) Alkaline corrosive liquids, n.o.s., alkaline caustic liquids, n.o.s., alkaline corrosive battery fluids, potassium hydrogen fluoride solution, sodium hydroxide solution, potassium hydroxide solution and sodium aluminate, liquid, when offered for transportation by carriers by rail freight, must be packed in specification containers of a design and constructed of materials that will not react dangerously with or be decomposed by the chemical packed therein as follows:

(1) In containers prescribed in § 73.245 of this part.

(2) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes with glass or earthenware inside containers, not over 2 gallons each, or with metal inside containers, not over 5 gallons each.

(3) Spec. 5 or 5A. Metal barrels or drums, with openings not exceeding 2.3 inches in diameter.

(5) Spec. 103, 103W, 103A, 103AW, 103B, 103BW, 104, 104W,

[1] Use of existing tank cars authorized, but new construction not authorized.

105A100, 105A100W, 111A60F1, 111A60W1, 111A100F1, 111A100W1, 111A100F2, 111A60W2, 111A100W3, 111A100W4, or 111A60W5. Tank cars.

(7) Spec. 57 or 60. Portable tanks.

(8) Spec. 12B. Fibreboard boxes with glass inside containers of not over 16 ounces capacity each.

(10) Spec. 12B. Fibreboard boxes, with not more than one glass inside container not over 1 gallon capacity containing sodium hydroxide solution not over 25 per cent strength and packed in a strong fibreboard box. Dry chemicals for photographic development process not classed as dangerous articles, contained in suitable inside packages, may be packed in the same outside box.

(11) Spec. 29. Mailing tubes, with no more than one inside polyethylene bottle not over 1-quart capacity each.

(12) Spec. 1H. Metal crate with inside polyethylene container spec. 2T.

(13) Spec. 12B. Fibreboard box with inside metal containers. Not more than four 1-gallon or six 1-quart containers may be packed in each box. Maximum gross weight may not exceed 65 pounds and the completed package must meet the test requirements of paragraph 10 of specification 12A.

(b) The commodites named in paragraph (a) of this section, when offered for transportation by rail express, must be packed in specification containers as follows (also authorized for transportation by carriers by rail freight):

(1) In containers as prescribed in subparagraphs (a)(8), (10), and (11) of this section and § 73.245(a)(7) and (12).

(2) Spec. 5 or 5A. Metal barrels or drums, capacity not exceeding 8½ gallons, with openings not exceeding 2.3 inches in diameter.

(3) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes with glass or earthenware inside containers not over 1 gallon each, or with metal cans not over 5 gallons each.

(c) Inside containers of not more than 1 pint capacity each, resistant to lading, packed in strong outside containers, and cushioned with absorbent material in sufficient quantity to completely absorb liquid contents in the event of breakage, are exempt from specification packaging requirements.

§ 73.249a Dye intermediates, liquid, n.o.s. (a) Dye intermediates, liquid, n.o.s., shall be packaged as follows:

(1) in packagings as prescribed in 73.245

(2) in packagings meeting the requirements prescribed in 73.245 including packaging type and quantity limitations for inside packagings. The packagings are not required to meet the detailed specification requirements of Part 78 of these regulations except that size and weight limitations for package types as prescribed in Part 78 may not be exceeded,

(3) in removable (open) head fiber drums, lined or coated on the inside with a plastic material, and not over 250 litre capacity,

(4) in removable (open) head metal drums, not over 250 litre capacity, or

(5) in removable (open) head polyethylene drum, not over 25 litre capacity.

§ 73.250 Automobiles or other self-propelled vehicles, engines or other mechanical apparatus. (a) Automobiles and other self-propelled vehicles equipped with electric storage batteries, wet, or with electric storage batteries, wet, removed from vehicles; and electric storage batteries, wet when included in carload shipments of automobile parts or assembled material in accordance with subparagraphs (a) (1), (2), and (3) are exempt from specification packaging requirements. (See also §73.257 (b)).

(1) When batteries are removed from automobiles and loaded into car therewith, the batteries must be so loaded, blocked, and braced in car as to prevent movement therein during transit, and the load must be so arranged that loose articles cannot come into contact with the batteries.

(2) When wet batteries or batteries shipped dry in the same container with electrolyte (acid) are shipped with automobile parts or assembly material, the batteries must be boxed or crated and so loaded, blocked, and braced in the car as to prevent movement therein during transit, and the load must be so arranged that loose articles cannot come in contact with the batteries.

(3) When batteries are installed in the vehicle, they must be completely protected so that short circuits will be prevented and so secured that leakage of acid will not occur under conditions normal to transportation.

(b) Engines or mechanical apparatus of such size or weight as to require securement to skids to facilitate handling may have electric storage batteries, wet, necessary for the operation thereof, either securely fastened in the holder provided on the equipment and protected, including battery terminal in such manner as to prevent damage thereto or short circuits, or completely boxed in containers of sound lumber and with filling holes upright, securely fastened to the skids upon which the engine or mechanical apparatus is mounted to prevent accidental tipping or looseness in transportation. Electric storage batteries, wet, as described herein are exempt from specification packaging.

§ 73.250a Phenyl phosphorus dichloride and phenyl phosphorus thiodichloride. (a) Phenyl phosphorus dichloride and phenyl phosphorus thiodichloride must be packed as follows:

(1) In packagings prescribed in § 73.245 which are made of or lined with material compatible with the lading.

(3) Spec. 103AW. Tank cars. Tanks must be lined.

§ 73.251 Boron Trichloride and boron tribromide. (a) Boron trichloride must be packed in specifcation containers as follows:

(1) Specification steel or nickel cylinders as prescribed for any compressed gas except acetylene.

(2) Specifications 105A300W or 106A500X. Tank cars.

(b) Boron tribromide must be packed in specification packagings as follows:

(1) Specification 15A, 15B, 15P, or 19B. Wooden or plywood boxes with inside glass receptacles not over 1 quart capacity each. Each glass receptacle must have a positive closure (not friction) and as prepared for shipment must be capable of withstanding an internal gauge pressure of at least 15 p.s.i. The receptacle must be cushioned with sufficient absorbent incombustible material to completely absorb the content in the event of leakage and must be packed within a securely closed metal can. Each can must then be cushioned with incombustible material within the prescribed outside packaging. Completed packaging for shipment must be capable of passing the tests pre-

scribed in paragraph 3(a)(1) of Spec. 15P.

(2) Spec. 5C or 5M. Metal drums not exceeding 25 gallons capacity, Specification 5C drums must be constructed of at least 14-gauge stainless steel.

(3) spec. 37A. Steel drums not over 25-gallon capacity each with inside glass receptacles not over 1-quart capacity each. Inside containers and cushioning must comply with paragraph (b)(1) of this section. Not more than four 8-ounce glass receptacles or two 1-quart glass receptacles may be packed within one 7-gallon 37A drum. Not more than twelve 8-ounce glass receptacles or six 1-quart glass receptacles may be packed within one 25-gallon 37A drum. Completed package must meet test requirements of paragraph 11 of Specification 37.

§ 73.252 Bromine. (a) Bromine must be packed in specification containers as follows:

(1) Spec. 15A, 15B, or 19B. Wooden boxes with glass inside containers not over 1 quart each; or with stone or earthenware jugs not over 1 gallon each.

(3) Spec. 105A300W. Tank cars. The tank must be nickel clad at least 20 per cent or must be lined with lead at least 3/16" thick; openings in tank heads to facilitate application of lead lining are authorized and must be closed in an approved manner; all closures and appurtenances which are in contact with the lading must be lead lined or must be made of metal not subject to rapid deterioration by contact with the lading; all interior welds in nickel clad tanks must be protected by pure nickel butt straps to eliminate iron contamination. Except as otherwise provided herein the water weight capacity of the tank must not be more than 20,400 pounds, and the maximum quantity of liquid bromine loaded into the tank must not be more tan 60,000 pounds or 300 per cent of the water weight capacity of the tank, whichever quantity is the lesser. In no case shall the quantity loaded be less than 98 per cent of the quantity the tank is authorized to carry. When tanks are equipped with manhole cover plates, safety valves, venting, loading and unloading valves in accordance with spec. 105A300W, and tank jackets are stencilled 105A300W, but in all other respects are constructed and maintained in full compliance with spec. 105A500W, the water weight capacity of the tank must not be more than 37,400 pounds, and the maximum quantity of liquid bromine loaded into the tank must not be more than 110,000 pounds or 300 per cent of the water weight capacity of the tank, whichever quantity is the lesser.

(4) Spec. 33A. Polystyrene case (nonreusable container) having not more than four inside glass jugs of not over 80 fluid ounces (2.5 litres) each. The polystyrene case must be further overpacked in a strong fibreboard box of at least 275-pound test and adequately cushioned.

(5) Spec. 15A. Wooden boxes (having an authorized gross weight of not less than 100 pounds) having not more than four inside glass jugs of not over 80 fluid ounces (2.5 litres) each. Jugs must be cushioned with an appropriate absorbent material.

(b)Outage (vacant space above liquid) for inside containers must be not less than 15 per cent of capacity of container.

(c) For other authorized containers an outage of not less than 10 per cent is required.

(d) Inside containers must be closed by glass, earthenware or stone stoppers ground to fit and securely fastened; or bottles may have necks with molded screw threads which must be closed by threaded-type caps with lead or other efficient bromine-resistant gaskets and cushioned by elastic material to insure tight closure. Sealed glass ampoules are also authorized.

(e) Except as provided in paragraphs (g) (2) and (3) of this section, bottles or jugs must be securely cushioned on all sides with incombustible packaging material, such as whiting, mineral wool, infusorial earth (keiselguhr), sifted ashes, powdered china clay, or similar material at least 1 inch thick, which will not produce heat when mixed with bromine. The use of hay, sawdust, excelsior or other organic material, either treated or untreated, as a cushioning or packaging material is prohibited.

(f) Not more than 15 quarts of bromine in bottles, nor more than 12 quarts in jugs, may be packed in one box.

(g) Bromine which has been dried in accordance with good commercial practice may also be packed in specification containers as follows:

(1) Spec. 5K or 5M. Nickel or monel drums of not over 8½ gallons capacity each and containing not more than 225 pounds net weight of bromine. Drums must be of metal at least 14 gauge United States standard throughout and must have chime reinforcement adequate for their protection. All openings must be in one head and closing parts (plug, cap, flange, etc.) must be of the same metal as the drum. One opening not over 2.3 inch diameter and one opening not over ¾ inch standard pipe size are permitted. Each drum must be completely emptied and dried before reuse and must be equipped with gaskets of a material approved by the Director of Operation, R.T.C.

(2) Spec. 12A. Fibreboard boxes, constructed of at least 275 test (Mullen or Cady) double-wall corrugated fibreboard having not more than six inside glass bottles of not over 1-quart capacity. Each inside glass bottle must be surrounded by a sheet of polyethylene foam at least 7/16 inch thick, (see Note 1) and approximately the same height as the bottle, and must also be separated by a partition made of corrugated fibre-board at least 275 pound test (Mullen or Cady). The box must be provided with inside top and bottom pads of polyethylene foam at least 1⅛ inches thick (see Note 1). Shipper must have established that the completed package closed as for shipment with inside containers filled with liquid of same specific gravity as commodity to be shipped is capable of withstanding tests prescribed by para. 10 of Specification 12A.

NOTE 1: Other materials of equal efficiency and compatibility are also authorized.

(3) Spec. 12A. Fibreboard box with inside glass bottles having closures meeting the requirements of paragraph (d) of this section. Each bottle must be enclosed in a tinplate slipcover metal can surrounded by incombustible cushioning material. No box may contain any bottle of a capacity greater than 1 quart. Each box may contain not more than four bottles having a capacity not exceeding 1 quart or 12 bottles having a capacity not exceeding 8 fluid ounces. The shipper must have established that the complete package closed for shipment, with inside bottles filled with a liquid of the same specific gravity and similar viscosity as bromine, is capable of withstanding the tests prescribed in paragraph 10 of Spec. 12A.

§ 73.253 Chloracetyl chloride. (a) Chloracetyl chloride must be packed in specification containers as follows:

(1) Spec. 15A, 15B, or 19B. Wooden boxes, with inside glass containers not over 5 pints capacity each, cushioned with incombustible material.

(5) Spec. 5K. Nickel drums.

(7) Spec. 103AW, 111A100F2, or 111A60W2 tank cars. Tanks

must have a nickel cladding of 1/16 inch minimum thickness. Nickel cladding in tanks must have a minimum nickel content of at least 99 per cent pure nickel.

(8) Spec. 103ANW. Tank cars. Tank must be of solid nickel at least 99% pure and all cast metal parts of the tank in contact with the lading must have a minimum nickel content of approximately 96.7%.

§ 73.254 Chlorosulphonic acid and mixtures of chlorosulphonic acid-sulphur trioxide. (a) Chlorosulphonic acid and mixtures of chlorosulphonic acid-sulphur trioxide must be packed in specification containers as follows:

(1) Spec. 5A or 5C. Metal barrels or drums.

(2) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes, with inside containers which must be glass or earthenware, not over 1 gallon each, except that inside containers up to 3 gallons are authorized when only one is packed in each outside container.

(3) Spec. 11A or 11B. Wooden barrels, with inside glass or earthenware containers not over 2 gallons each.

(4) Spec. 103A[1], 103AW, 103CW, 103EW, 111A100F2, 111A60W2, or 111A60W7 tank cars.

§ 73.255 Dimethyl sulphate. (a) Dimethyl sulphate must be packed in specification containers as follows:

(1) Spec. 5A or 5C. Metal barrels or drums not over 46 gallons each. Spec. 5C metal barrels or drums must be constructed of Type 304 stainless steel.

(2) Spec. 5. Metal barrels or drums not over 12½ gallons each, with opening not exceeding 2.3 inches in diameter, enclosed in strong crates made of lumber at least 5/8 inch thick.

(3) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes with each box containing a single glass inside container not over 1 quart capacity, closed by ground glass stopper or other equally efficient closure securely fastened in place, and cushioned with incombustible absorbent material in hermetically sealed (soldered) metal can, the can then being cushioned with incombustible cushioning material in the outside container.

(4) Spec. 103A[1], 103A-W, 111A100-F-2, or 111A100-W-2 tank cars.

(6) Spec. 12B. Fibreboard boxes with each box containing not more than six inside glass containers not over 1-quart capacity each, closed by plastic screw-cap resistant to the lading, and each completely surrounded by incombustible absorbent cushioning material and enclosed in a metal can having rolled, seamed-on heads of a key-opening type; or in not more than six inside glass containers not over 1-quart capacity each, closed by ground glass stopper, by plastic screw-cap resistant to the lading, or by other equally efficient closure securely fastened in place, and cushioned with incombustible absorbent material in hermetically sealed (soldered) metal can, the can then being cushioned with incombustible cushioning material in the outside container.

§ 73.257 Battery fluid, acid or battery fluid, alkaline. (a) Battery fluid, acid must not be over 47 percent strength (39° Baumé). Battery fluid must be packed in specification containers as follows:

(1) As prescribed in § 73.272 of this part except that unlined tank cars and metal barrels or drums must not be used.

(3) When the material is alkaline it may also be shipped when packed in containers as prescribed in § 73.249 of this part.

(5) Spec. 60. Portable tanks, except that unlined tanks must not be used.

(6) Spec. 12B or 12C. Fibreboard boxes with inside containers of polyethylene or other electrolyte acid resistant nonfragile materials having secure closures capable of withstanding conditions incident to transportation without leakage and unless containers are rigid or semi-rigid in nature they must be contained in other strong inside containers; minimum thickness of polyethylene or other materials shall be not less than 0.003 inch for any film sheet for multi-wall containers or not less than 0.006 inch for single-wall containers; not more than 12 such inside containers shall be packed in one outside box. Inside containers shall be packed to prevent movement within the box (see paragraph 34 of Spec. 12B and paragraph 19 of Spec. 12C). Dry storage batteries or battery charger device may be packed in the same outside box when adequately separated from other inside containers (see paragraph 33 of Spec. 12B); gross weight of completed package shall not exceed 65 pounds, except when acid is packed in individual inside containers the gross weight shall be not over 75 pounds. Complete package, closed as for shipment, with inside containers filled with liquid of same specific gravity as commodity to be shipped, must be capable of withstanding at least 2 drops from a height of 4 feet onto solid concrete without leakage from or rupture of inside containers.

(7) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes with inside containers of polyethylene, or other electrolyte acid resistant plastic, not over 1 gallon each.

(8) Spec. 1EX. Carboys in plywood drums (single-trip).

(9) Spec. 12B. Fibreboard boxes constructed of at least 275-pounds test (Mullen or Cady) double-wall corrugated fibreboard or 325-pound test (Mullen or Cady) double-faced corrugated fibreboard, with not more than 12 inside glass bottles, having acid-proof closures, of not over 1 quart capacity each. Inside glass bottles must be separated and cushioned by suitable corrugated fibreboard partitions. The box must be equipped with top and bottom pads. (See paragraph 32, Spec. 12B.)

(10) Spec. 12B. Fibreboard boxes having not more than 1 inside glass bottle, with acid-proof closure, not over 1 gallon capacity. Box shall be constructed of at least 350-pound test (Mullen or Cady) double-faced corrugated fibreboard of full depth telescope type. Cushioning and closure of box (pressure sensitive tape may be used) must be such that a representative box, with inside glass bottle filled with water, shall be capable of withstanding two drops from a height of 4 feet onto solid concrete without breakage of inner bottle or failure of the closure.

(11) Spec. 12A. Fibreboard boxes with inside glass bottles not over 1 gallon capacity each. Not more than 4 inside containers exceeding 5 pints capacity each shall be packed in the outside container. Shipper must have established that the completed package meets test requirements prescribed by paragraph 10 of Spec. 12A.

(12) Spec. 37P. Steel drums with polyethylene liner (nonreusable container).

(13) Spec. 34. Polyethylene drum.

(14) Spec. 12B. Corrugated fibreboard boxes with plastic bags as defined in paragraph 37 specification 12B.

(b) Shipments of electrolyte (acid) or corrosive battery fluid with vehicles or engine driven equipment offered for transportation by, for, or to the Department of National Defence are exempt from these regulations when packed as follows:

(1) In one inside glass or polyethylene bottle of not over one

[1] Use of existing tank cars authorized, but new construction not authorized.

gallon capacity, tightly and securely closed in a strong outside container. Inside glass bottle shall be cushioned therein on all sides with incombustible absorbent material in sufficient quantity to absorb liquid contents in event of breakage. When shipped within or on a motor vehicle or with engines or other mechanical apparatus the outside container must be so blocked, braced, or stayed that it cannot change position during transit.

(c) Electrolyte acid or corrosive battery fluid contained in polyethylene containers not over 2 quarts capacity each and packaged not more than three containers in specification 15A, 15B, 15C, 16A, 19A, or 19B wooden boxes, or packaged as prescribed in paragraph (a) (6) of this section, may be securely attached to self-propelled vehicles or mobile agricultural machinery, or securely braced on a railcar floor.

(d) Strong, tightly closed metal drums not over 12½ gallons capacity each, having not to exceed 25—1 pint polyethylene, or other suitable plastic bottles, securely cushioned therein. Shipments authorized only by, for or to the Department of National Defence. The drum containing the electrolyte acid or corrosive battery fluid may be securely attached to another steel drum containing a dry, charged storage battery or batteries.

§ 73.258 Battery fluid, acid or battery fluid, alkaline, packed with storage batteries. (a) Battery fluid, acid or battery fluid, alkaline, packed with storage batteries, except as provided in § 73.257(a)(6) must be packed in specification containers as follows:

(1) Spec. 15D or 16B. Wooden boxes with inside containers of glass bottles not over 1 gallon each nor over 2 gallons total in each outside container. Inside containers must be well cushioned and separated from batteries by a strong solid wooden partition.

(2) Electrolyte, acid, or alkaline corrosive battery fluid included with storage batteries and filling kits may be packed in strong plywood or wooden boxes when shipments are made by, for or to the Department of National Defence in outside containers of their specifications, provided the electrolyte, acid, or alkaline corrosive battery fluid is packed in polyethylene bottles not over 1 quart capacity each and not more than 24 bottles securely separated from storage batteries and kits may be shipped in one outside package.

(3) Spec. 12B. Fibreboard boxes with not more than 12 inside containers of polyethylene or other material resistant to the lading, not over 2 quart capacity each. Polyethylene containers that are not rigid or semi-rigid in nature must be contained in other strong inside containers; minimum thickness of polyethylene or other plastic material shall be not less than 0.003 inch for any film sheet for multi-wall containers or not less than 0.006 inch for single-wall containers. Inside containers must be adequately separated from the storage battery. Authorized gross weight not over 65 pounds. (See paragraph 33, Spec. 12B.)

§ 73.259 Battery fluid, acid, or battery fluid, alkaline, packed with battery charger, radio current supply device, or electronic equipment and actuating devices. (a) Battery fluid, acid, or battery fluid, alkaline, packed with battery charger, radio current supply device or parts thereof, or electronic equipment and actuating devices with only one device or outfit in each package, in the amount necessary for operation of the device or equipment provided the containers of battery fluid, acid, or battery fluid, alkaline, are adequately cushioned to prevent breakage, leakage, or damage to other articles packed therewith, must be packed in specification containers or as otherwise authorized herein, as follows:

(1) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes, provided the liquid is in bottles securely closed and cushioned as prescribed in paragraph (a) of this section, and separated from charger supply device, and parts, or electronic equipment by a strong solid wooden partition.

(2) Spec. 12B. Fibreboard boxes, when the liquid is in a strong bottle not exceeding 1 pint, which must be securely closed and cushioned as prescribed in paragraph (a) of this section. Not more than 12 such packages may be packed in one outside container.

(3) Battery fluid, acid, or battery fluid, alkaline, in separate inside acid or alkaline fluid resistant containers not over 5 gallons capacity each included with electronic equipment and actuating devices are authorized in strong, tightly closed steel drums.

§ 73.260 Electric storage batteries, wet. (a) Electric storage batteries, containing battery fluid, acid or battery fluid, alkaline, must be completely protected so that short circuits will be prevented; they must not be packed with other articles except as provided in §§ 73.250 and 73.258, portable searchlights properly cushioned, battery parts, or hydrometers, securely packed in a separate container. The batteries either with or without other articles must be packed in specification containers as follows:

(1) Spec. 15D or 16B. Wooden or wirebound wooden boxes except as provided in paragraphs (b) and (c) of this section.

(2) Spec. 12B. Fibreboard box as authorized by paragraphs 25(a), 28(a) and 35(a) of Spec. 12B.

(3) Electric storage batteries with case of asphaltum composition, impregnated rubber, steel case type, synthetic resin (plastic), or wooden battery box type, protected against short circuits and firmly secured to skids or pallets capable of withstanding the shocks normally incident to transportation, are exempt from specification packaging requirements for transportation by rail freight. The height of the completed unit must not exceed 1½ times the width of the skid or pallet. The unit must weigh not less than 300 pounds gross and must not fail under a superimposed weight equal to two times the weight of the unit or a superimposed weight of 4,000 pounds if the weight of the unit exceeds 2,000 pounds. Battery terminals must not be relied upon to support any part of the superimposed weight.

(4) Electric storage batteries weighing 500 pounds or more, with case of asphaltum composition, impregnated rubber, steel case type, synthetic resin (plastic), or wooden battery box type, consisting of carriers' equipment may be shipped by rail freight when mounted on suitable skids and protected against short circuits. Such shipments must not be offered in interchange.

(b) Electric storage batteries with case of asphaltum composition, impregnated rubber, steel case type, synthetic resin (plastic), or wooden battery box type; packing authorized as follows:

(1) One to three batteries not over 25 pounds each in outside box, gross weight not over 75 pounds; specification container not required.

(2) Not more than four batteries not over 15 pounds each may be packed in strong outside fibreboard or wooden boxes, when securely cushioned and packed to prevent short circuits; specification container not required. Authorized gross weight 65 pounds.

(3) Not more than five batteries not over 10 pounds each may be packed in strong outside fibreboard or wooden boxes, when securely cushioned and packed to prevent short circuits; specification container not required. Authorized gross weight 65 pounds.

(c) Single batteries not exceeding 75 pounds each, in addition to requirements of paragraphs (a) and (b) of this section, may be shipped in 5-sided slip covers or in completely closed fibreboard boxes, of solid or double faced corrugated fibreboard complying with the following: (See paragraph (a) (1) of this section for more than one battery in an outside container.

(1) Slip cover or fibreboard box must fit snugly and provide inside top clearance of at least ½ inch above battery terminals and filler caps with reinforcement in place. Assembled for shipment, the bottom edges of the slip cover may extend to the base of the battery but must not expose more than 1 inch thereof.

(2) Top of slip cover or fibreboard box design must comply with the following:

(i) Top of slip cover or fibreboard box must have interior reinforcement (insert or saddle) of fibreboard, wood, or other material of equal strength or rigidity so formed that any superimposed weight will bear only and directly downward on the top edges of the battery case or intercell connectors (straps), or plastic battery terminal covers designed to transmit any superimposed weight directly to the top inner wall of the battery case, or fibreboard boxes with chip board and chip board jute lined tubes which shall fit directly over the terminal posts and rest directly on battery cell covers.

(ii) Or be protected by a scored one piece cover-liner of 200-pound test (Mullen or Cady) double-faced corrugated fibreboard extending from the base of the battery on one side, across the top of the battery and to the base of the battery on the opposite side.

(iii) Or a five-sided slip cover having top of only one thickness of fibreboard, with lengthwise inner flaps roll folded to form a reinforcement of such height as to provide clearance required by paragraph (c) (1) of this section which shall rest on the side edges of the battery. Outer end flaps to overlap approximately one inch and shall be butt folded and tucked into a centre slot cut in the inner flaps. The requirements of subparagraphs (i) and (iv) of this paragraph do not apply.

(iv) When top of slip cover or fibreboard box consists of only one thickness of material, reinforcement must have a plane surface of same interior dimensions and thickness. Reinforcement must be of such height as to provide minimum clearance required above and must be constructed to remain securely in place or be fastened to slip cover or fibreboard box.

(3) All fibreboard must be at least 200-pound test (Mullen) and completed package (battery and slip cover or fibreboard box) must be capable of withstanding top-to-bottom compression test of at least 500 pounds without damage to battery terminals, battery cell covers, and filler caps.

(d) Nonspillable wet electric storage batteries capable of withstanding the tests prescribed in subparagraphs (1) and (2) of this paragraph without leakage of battery fluid are excepted from all other requirements of this part when protected against short circuits and securely packaged so as to withstand conditions normal to transportation.

(1) Vibration test. Battery is rigidly clamped to the platform of a vibration machine and a simple harmonic motion having an amplitude of 0.03 inches (0.06 inches maximum total excursion) is applied. The frequency is varied at the rate of one cycle per second per minute between the limits of 10 to 55 cycles per second. The entire range of frequencies and return is traversed in 95 minutes for each mounting position (direction of vibration) of the battery. The battery must be tested in three mutually perpendicular positions (to include testing with fill openings and vents, if any, in an inverted position) for equal time periods.

(2) Pressure differential test. Following the vibration test, the battery is stored for six hours at 75°F. ± 7°F. under an external partial pressure of 2 pounds per square inch absolute. The battery must be tested in three mutually perpendicular positions (to include testing with fill openings and vents, if any, in an inverted position) for at least six hours in each position.

(e) Electric storage batteries containing battery fluid are exempt from specification packaging if the batteries (either wet or dry) are the only commodity being transported in a car, trailer or container and are loaded and braced to prevent damage in transit and short circuits.

(g) Electric storage batteries, containing battery fluid, acid, or battery fluid, alkaline in a coil from which it is injected into the battery cells by a gas generator and initiator assembled with the battery, and which are nonspillable and leakproof, are exempt from these Regulations when approved by the Director of Operation, R.T.C.

§ 73.261 Fire-extinguisher charges. (a) Fire-extinguisher charges consisting of sulphuric acid in glass inside containers securely closed may be packed with bicarbonate of soda in specification containers as follows:

(1) Spec. 15A, 15B, 15C, 16A, 19A, or 19b. Wooden boxes with glass inside containers not over 5 pints each, cushioned.

(2) Spec. 21C. Fibre drums with a single inside container consisting of a glass bottle not over 64 fluid ounces capacity filled with not over six pounds by weight of sulphuric acid (approximately 50 fluid ounces by volume). Bottle must be suspended in center of outside container by means of adequate supports and surrounded by bicarbonate of soda in sufficient quantity to fill drum and neutralize contents in the event of breakage.

(b) Fire-extinguisher charges as described in subparagraphs (1) to (3) of this paragraph are exempt from specification packaging requirements for transportation by rail freight or rail express.

(1) Fire-extinguisher charges consisting of sulphuric acid in strong 8-fluid ounce or smaller bottles, securely closed and packed with bicarbonate of soda completely surrounding the bottles of acid in outside fibreboard or wooden boxes. Closure must consist of a metal cap lined with an acid-resistant washer or a composition stopper of material that will not be attacked by the acid.

(2) Fire-extinguisher charges, consisting of chlorosulphonic acid in a hermetically sealed bottle not exceeding 2 ounces capacity, securely packed in a metal container enclosed in another metal container, the inner metal container being cushioned in the outer metal container with asbestos fabric and the completed package embedded in potassium carbonate in outside fibreboard or wooden boxes.

(3) Fire-extinguisher charges, consisting of sulphuric acid in 10-ounce or smaller bottles, securely closed, packed in a tight fibre carton. Closure must consist of a metal cap lined with an acid-resistant washer or a composition stopper of material that

will not be attacked by the acid. The bottle and carton packed in either potassium carbonate or potassium carbonate and alkali packed in a cylindrical tin can, with slip cover, secured by tape in outside fibreboard or wooden boxes.

§ 73.262 Hydrobromic acid. (a) Hydrobromic acid not over 49 per cent strength must be packed in specification containers as follows:

(1) Spec. 1A or 1D. Carboys in boxes.

(2) Spec. 1X. Boxed carboys single-trip for export only are authorized to be transported to ship side by rail freight in carload lots only.

(3) Spec. 11A or 11B. Wooden barrels or kegs with glass or earthenware inside containers, not over 2 gallons each.

(4) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes with inside containers which must be glass or earthenware, not over 1 gallon each, except that inside containers up to 3 gallons are authorized when only one is packed in each outside container.

(6) Spec. 103B[1], 103BW, or 111A60W5 tank cars.

(7) Spec. 12A. Fibreboard boxes with inside glass bottles not over 5 pints capacity each. Not more than six 5-pint glass bottles may be packed in one outside container. Shipper must have established that the completed package meets test requirements prescribed by paragraph 10 of Spec. 12A.

(8) Spec. 37P. Steel drums, not over 5-gallons capacity, with polyethylene liner (nonreusable container). Drums exceeding 1-gallon capacity must be constructed of at least 24 gauge metal.

(9) Spec. 22C. Plywood drum as prescribed by subparagraph 2(a) specification 22C, with inside spec. 2T polyethylene container.

(10) Spec. 6D. Cylindrical steel overpack with inside spec. 2S polyethylene container.

(12) Spec. 37M. Non-reusable cylindrical steel overpack with inside Spec. 2SL polyethylene container. Overpack must have rolled hoops and be constructed of 20-gauge body and 18-gauge head.

(b) Hydrobromic acid greater than 49 per cent strength but not over 63 per cent strength must be packed in specification containers as follows:

(1) Spec. 22C. Plywood drum as prescribed by subparagraph 2(a) specification 22C, with spec. 2T polyethylene container.

(2) Spec. 6D. Cylindrical steel overpack with inside spec. 2S or 2SL polyethylene container.

(3) Spec. 15A, or 19B. Wooden box having only one polyethylene bottle, with screw-cap closure, not over one-gallon capacity.

(6) Spec. 12A. Fibreboard box with not more than four inside glass bottles not over one quart capacity each, or 12 inside glass bottles not over eight fluid ounces each. Each bottle must be enclosed in a metal can and surrounded by an incombustible cushioning material. Box shall be constructed of at least 275-pound test (Mullen or Cady) corrugated fibreboard.

§ 73.263 Hydrochloric acid, hydrochloric acid solution, inhibited, hydrochloric acid mixtures and sodium chlorite solution, not exceeding 42 percent sodium chlorite. (a) The above commodities must be packed in specification containers as follows:

(1) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes with inside containers which must be glass, earthenware, polyethylene or other nonfragile plastic material resistant to the lading (bags are not authorized), not over 1 gallon each, except that inside containers up to 3 gallons each are authorized when only one is packed in each outside container.

(4) Spec. 11A or 11B. Wooden barrels or kegs with glass or earthenware inside containers not over 2 gallons each.

(5) Spec. 1A, or 1K. Carboys in boxes or kegs.

(6) Spec. 1X. Boxed carboys; single-trip for export only are authorized to be transported to ship side by rail freight in carload lots only.

(7) Spec. 1D, or 1EX (single-trip). Glass carboys in boxes or plywood drums, of not over 5½ gallons nominal capacity. Means shall be provided so that accumulated total pressure in bottle shall not exceed 10 psi. gauge at 130°F. or shall vent at a pressure not to exceed 10 psi. gauge.

(9) Spec. 103B[1], 103BW, or 111A60W5 tank cars. Authorized for acid not over 38 per cent strength by weight.

(11) Spec. 60. Portable tanks, rubber-lined.

(12) Spec. 103CW or 111A60W7 tank cars having tanks of type 304L stainless steel. Authorized for sodium chlorite solution not exceeding 40 per cent sodium chlorite only.

(13) Spec. 1H, 15P, or 22C. Metal crate with inside polyethylene carboy; or glued plywood or wooden box, or plywood drum as prescribed by subparagraph 2(a) Specification 22C, with inside spec. 2T or spec. 2TL polyethylene container.

(14) Spec. 17H, 37A, or 37B. Metal drums (single-trip) not over 5 gallons capacity each. Authorized only for hydrochloric (muriatic) acid solution, inhibited, containing not more than 15 per cent hydrochloric (muriatic) acid. Drums must be lined throughout with a pliable plastic material impervious to the solution. Spec. 37A and 37B metal drums must be at least 24 gauge steel.

(15) Spec. 12A or 12B, Fibreboard boxes with inside containers of polyethylene, or other nonfragile plastic material resistant to the lading (bags are not authorized), not over 1 gallon capacity each, suitably cushioned to prevent movement within the box. Gross weight of the completed package must not exceed 65 pounds.

(16) Spec. 12A. Fibreboard boxes with inside glass bottles not over 5 pints capacity each. Not more than six 5-pint glass bottles may be packed in one outside container. Shipper must have established that the completed package meets test requirements prescribed by paragraph 10 of Spec. 12A.

(17) Spec. 6D or 37M (nonreusable container). Cylindrical steel overpacks with inside spec. 2S, 2SL, 2T, 2TL, or 2U polyethylene container.

(18) Spec. 37P. Steel drums constructed of at least 24 gauge metal for drums exceeding 1-gallon capacity, with polyethylene liner (nonreusable container).

(19) Spec. 16D. Wirebound wooden overwrap, with inside spec. 2T, 2TL, 2S, or 2SL polyethylene container.

(20) Spec. 37A. Metal drum (single-trip) with inside polyethylene container, spec. 2T or 2TL. Removable head of steel drum may have holes of suitable size to provide for protruding neck and closure of inner container.

(21) Spec. 12C. Fibreboard boxes with inside 5-gallon nominal capacity polyethylene bottles having minimum wall thick-

[1] Use of existing tank cars authorized, but new construction not authorized.

ness of 0.015 inch and constructed with screw-type closures. Authorized gross weight not over 65 pounds. (See paragraph 19 of Spec. 12C).

(22) Spec. 21P. Fibre drum overpack with inside spec. 2T, 2S, 2SL, or 2U polyethylene container.

(23) Spec. 12P. Fibreboard boxes with one inside spec. 2U polyethylene container of not over 5 gallon capacity each or two inside spec. 2U polyethylene containers of not over 2½ gallon capacity each. Wire staples are not authorized for assembly or closure of boxes, except when polyethylene container is completely enclosed in inside boxes free of wire staples or other projections that could cause failures.

(24) Spec. 16A. Wirebound wooden box (See paragraph 22 Specification 16A) with inside specification 2U polyethylene container. The polyethylene container shall be separated from the wooden box by a complete corrugated fibreboard liner and top and bottom pads.

(25) Spec. 22C. Plywood drum as prescribed by Subparagraph 2(b) Specification 22C, with inside spec. 2TL polyethylene container not over 5 gallon nominal capacity.

(26) Spec. 33A. Polystyrene cases (nonreusable container) with inside glass bottles not over 5 pints capacity each. Not more than four 5-pint bottles may be packed in one outside container.

(27) Spec. 12R. Paper-faced expanded polystyrene board box with not more than six inside glass bottles or Spec. 2E inside polyethylene bottles, not over 5 pints capacity each.

(28) Spec. 34. Polyethylene drum.

(29) Spec. 12R. Paper-faced expanded polystyrene board box with not more than four Spec. 2E inside polyethylene bottles not over 1-gallon capacity each.

(b) Hydrochloric acid of not over 20 per cent strength (13.25° Baumé) and other corrosive liquids containing not over 20 per cent hydrochloric acid in addition to containers prescribed in paragraph (a) of this section may be shipped in specification containers as follows:

(2) Inside containers of not more than 1 pint capacity each, resistant to lading, packed in strong outside containers, and cushioned with absorbent material in sufficient quantity to completely absorb liquid contents in the event of breakage, are exempt from specification packaging requirements for transportation by rail freight or rail express.

(c) When hydrochloric acid contains oils or solvents it must not be shipped in containers or tank cars lined with rubber.

(d) Hydrochloric acid mixtures of not over 28 per cent strength, in addition to the provisions of paragraphs (a) and (b) of this section, may be packed in specification containers as follows:

(1) Spec. 12B. Fibreboard boxes constructed of at least 275-pound test (Mullen or Cady) double-wall corrugated fibreboard or 325-pound test (Mullen or Cady) double-faced corrugated fibreboard, with not more than 12 inside glass bottles, having acid-proof closures, of not over 1 quart capacity each. Inside glass bottles must be separated and cushioned by suitable corrugated fibreboard partitions. The box must be equipped with top and bottom pads. (See paragraph 32 spec. 12B.)

(2) Spec. 12A. Fibreboard boxes with inside glass bottles not over 1 gallon capacity each. Not more than 4 inside containers exceeding 5 pints capacity each shall be in the outside container. Shipper must have established that the completed package meets test requirements prescribed by paragraph 10 of spec. 12A.

§ 73.264 Hydrofluoric acid. (a) Hydrofluoric acid shall be packed in specification containers as follows:

(1) Spec. 15A, 15B, 15C, 16A, 19A or 19B. Wooden boxes with inside containers of natural rubber, ceresine, lead, or other hydrofluoric acid resistant material. These containers are authorized only for strengths of acid for which they are adequate, but in no case may the strength of acid exceed 70 per cent.

(2) Spec. 12B. Fibreboard boxes with Spec. 2E inside polyethylene bottles or inside receptacles of not over 1 pound capacity each, made of natural rubber, lead, or other hydrofluoric resistant plastic. Authorized only for acid not over 70 per cent in strength.

(3) Spec. 16D. Wirebound wooden overwrap, with inside spec. 2T polyethylene container. Authorized for hydrofluoric acid not over 70 per cent strength.

(4) Spec. 12A or 12B. Fibreboard boxes with not more than four Spec. 2E inside polyethylene bottles, having a minimum thickness of 0.030 inch and not over 1 gallon (nominal) capacity each. Bottle closures must be made secure by sealing with pressure-sensitive plastic tape or other equally efficient means. Authorized for acid not over 70 per cent strength. Authorized gross weight for Spec. 12B fibreboard boxes not over 65 pounds; Spec. 12A not over 80 pounds.

(8) Spec. 103AW, 105A100W, 111A100F2, 111A60W2, 111A100W4. Unlined metal tanks which have been subjected to adequate passivity or neutralization process before being put into service. Authorized only for hydrofluoric acid of 60 to 80 per cent strength. If tanks are washed out with water they must be resubjected to passivity before reshipment.

(i) Hydrofluoric acid solutions of concentrations of 60 to 65 per cent when shipped in unlined metal tank cars must be inhibited so that the corrosive effect on steel is not greater than that of hydrofluoric acid of 65 per cent concentration.

(11) Spec. 103BW, 111A100W4, or 111A60W5. Tank cars, rubber-lined tanks. Authorized for acid not over 40 per cent strength, except Specification 111A100W4 tanks are authorized for acid not over 70 per cent strength.

(16) Spec. 15P or 22C. Glued plywood or wooden box, or plywood drums as prescribed by subparagraph 2(a) Specification 22C with inside spec. 2T polyethylene container. Authorized for acid not over 70 per cent strength.

(17) Spec. 6D or 37M (nonreusable) cylindrical steel overpacks with inside specifications 2S, 2SL, or 2T polyethylene liners. Specification 37M overpack of over 12-gallon capacity must be constructed of at least 20-gauge steel. Authorized only for acid of not over 70 per cent strength.

(18) Spec. 34. Polyethylene drum. Authorized only for hydrofluoric acid not over 52% strength.

(19) Spec. 12P. Fibreboard boxes with one inside Spec. 2U polyethylene container of not over 5-gallon capacity or two inside Spec. 2U polyethylene containers of not over 2½ gallon capacity each. Authorized only for acid of 48 to 52 per cent.

(b) Hydrofluoric acid, anhydrous (hydrogen fluoride) must be shipped in specification containers as follows:

(1) Spec. 3[2], 3A, 3AA, 3B, 3C, 3E, 4, 4A, 25[2], or 38[2], also spec. 4B, 4BA, 4BW or 4C if not brazed. Cylinders. Filling density must not exceed 85 per cent of the pounds water weight

[2] Use of existing cylinders authorized, but new construction not authorized.

capacity of the cylinder. Cylinders used exclusively in this service may, in lieu of the periodic hydrostatic retest required by § 73.34(e), be given a complete external visual inspection at the time such periodic retest becomes due. Such inspections shall be made only by competent persons and shall be made on cylinders cleaned to bare metal and results recorded on a suitable data sheet, completed copies of which shall be kept as prescribed in § 73.34(e)(5). Points to be checked and recorded on these data sheets are: Date of inspection (month and year) CTC or DOT specification number; cylinder identification (registered symbol and serial number, date of manufacture and if needed for adequate identification, ownership symbol); tare weight; physical condition (record specifically, if present; leakage, corrosion, gouges, dents or digs in shell or heads broken or damaged footring or protective ring or fire damage), disposition of cylinders (returned to service, to cylinder manufacturer for repairs, or scrapped): A cylinder which passes the inspection prescribed shall have the data recorded in the manner presently prescribed for the recording of the retest date except that an "E" is to follow the date (month and year) indicating requalification by the external inspection method. Cylinders removed from this service for any reason must be rendered unfit for any other regulatory service. (see § 73.28(L)).

(2) Spec. 105A300W, 112A400W, 114A400W, or ARA-V[1]. Tank car equipped with special valves and appurtenances approved (§ 79.3) for this service. For spec. 114A400W tanks, valves and fittings must be located on top of the tank. Bottom openings in tank are prohibited. The filling density may not exceed 90 per cent.

(4) Spec. 51. Portable tanks.

(5) Until further order of the Commission, samples of anhydrous hydrofluoric acid for laboratory examination are authorized for transportation by rail freight or rail express, when packed in aluminum cylinders, net capacity not exceeding 100 c.c., tested hydrostatically to 500 pounds per square inch and retested quinquennially, and shipped in strong wooden boxes. The cylinders must be cushioned so as to give proper protection to their valves. Filling density must not exceed 80 per cent of the water-tight capacity of the cylinder.

(6) Spec. 106A500X or 110A500W tanks. Tanks may not be equipped with safety devices of any type and valves must be protected by metal caps. Tanks must not be filled to a density in excess of 85 per cent of the water weight capacity of the tank. Authorized only for transportation by rail freight.

(c) Containers must not be entirely filled. Unless otherwise provided in this part, sufficient outage (vacant space) must be allowed so that the liquid portion will not completely fill the container at 130°F. in order to prevent leakage or distortion of containers due to the expansion of the contents from increase in temperature during transit.

§ 73.265 Hydrofluosilicic acid. (a) Hydrofluosilicic acid must be packed in specification containers as follows:

(1) Spec. 15A, 15B, 15C, 16A, 19A or 19B. Wooden boxes with inside containers of natural rubber, ceresine, or other material of equal efficiency resistant to hydrofluosilicic acid.

(2) Spec. 11A or 11B. Wooden barrels or kegs with inside containers of natural rubber or ceresine.

(4) Spec. 16A. Wirebound wooden box (See paragraph 22 Specification 16A) with inside specification 2U polyethylene container. The polyethylene container shall be separated from the wooden box by a complete corrugated fibreboard liner and top and bottom pads.

(b) Hydrofluosilicic acid of not exceeding 40 per cent strength may also be shipped when packed in specification containers as follows:

(3) Spec. 103B[1], 103BW, 111A60W5 or 111A100W2. Tank cars, rubber-lined or elastomer-lined tanks.

(c) Hydrofluosilicic acid containing no free hydrofluoric acid or other ingredient that will attack glass, may also be shipped when packed in specification containers as follows:

(1) Spec. 1A or 1D. Carboys in boxes, in kegs, or plywood drums, for which the use of rubber stoppers and gaskets is also authorized.

(2) Spec. 1X. Boxed carboys; single-trip for export only are authorized to be transported to ship side by rail freight in carload lots only.

(3) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes with inside glass containers, not over 1 gallon each, with rubber or ground-in glass stoppers properly secured.

(4) The vacant space in containers of these acids must be sufficient so that when raised to a uniform temperature of 130°F. the vapor pressure shall not exceed 6 pounds per square inch.

(d) Hydrofluosilicic acid, not exceeding 32 per cent strength, may also be shipped when packed in specification containers as follows:

(1) Spec. 12B. Fibreboard boxes with Spec. 2E inside polyethylene bottles or other plastic material resistant to the lading, not over 1-quart capacity each, suitably cushioned to prevent movement within the box. Gross weight of complete package must not exceed 65 pounds.

(2) Spec. 15P or 22C. Glued plywood or wooden box, or plywood drum as prescribed by subparagraph 2(a) Specification 22C with inside spec. 2T polyethylene container.

(3) Spec. 6D or 37M (nonreusable container). Cylindrical steel overpacks with inside spec. 2S or 2SL polyethylene container. Spec. 37M overpack shall be constructed of at least 20-gauge steel and shall not exceed 13½ gallons capacity each.

(4) Spec. 37P. Steel drums, not over 5-gallons capacity, with polyethylene liner (nonreusable container).

(5) Spec. 21P. Fibre drum overpack with inside spec. 2S, 2SL, or 2U polyethylene container.

(6) Spec. 34. Polyethylene container.

§ 73.266 Hydrogen peroxide solution in water. (a) Hydrogen peroxide solution in water containing over 52 per cent hydrogen peroxide by weight must be packed in specification containers as follows:

(1) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes with inside containers consisting of glass bottles not over 1 quart capacity each; bottles must have vented closure and must be packed in a metal container vented at bottom packed in another metal container vented at top; cushioning material shall be used between glass bottle and inner container and between inner and outer metal containers; cushioning material shall be vermiculite or equivalent in an amount at least 10 times the volume of the solution shipped and shall be wet with at least 10 per cent water by volume to which has been added a stabilizing agent.

(2) Spec. 42D. Aluminum drums with vented closure in top head; not over 25 gallons capacity; side openings not permitted.

[1] Use of existing tank cars authorized, but new construction not authorized.

(b) Hydrogen peroxide solution in water containing not over 52 per cent hydrogen peroxide by weight must be packed in specification containers as prescribed in paragraph (a) of this section or as follows:

(1) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes with glass or earthenware inside containers of not more than 1 gallon capacity each. Inside containers must be well cushioned. All material used for cushioning must be incombustible mineral matter, such as whiting, mineral wool, infusorial earth, asbestos, or sifted ashes. Cushioning of inside containers in outside wooden boxes by means of elastic packing, such as wooden strips or large corks fastened securely in position, is authorized if the completed package will pass the swing test prescribed for boxes carboys in spec. 1A.

(3) Spec. 42D. Aluminum drums with vented closure in top head; not over 46 gallons capacity.

(5) Spec. 12B. Fibreboard boxes with Spec. 2E inside polyethylene bottles having vented screw-cap closures not over 16-ounce capacity each. Each bottle must be completely contained in a securely closed polyethylene bag or tube constructed of material having minimum film thickness of 0.004 inch. Bottles must be separated from each other by use of fibreboard partitions or other suitable cushioning material. Not more than 12 bottles may be packaged in one box.

(6) Spec. 6D or 37M (nonreusable container). Cylindrical steel overpacks with inside spec. 2S or 2SL polyethylene container. The closures must be located in one head and must be vented to prevent accumulation of internal pressure.

(7) Spec. 21P. Fibre drum overpack with inside spec. 2SL polyethylene container, not over 25 gallons capacity, or spec. 2U polyethylene container, not over 13 gallons capacity. The closures of the inside 2SL and 2U container must be vented to prevent accumulation of internal pressure.

(8) Spec. 34. Polyethylene container. A closure of each container must be vented to prevent accumulation of internal pressure.

(9) Spec. 37P. Steel drums, not over 12½ gallon capacity, with inside Spec. 2U polyethylene containers having a minimum thickness of 0.015 mil. The closure of the inside 2U container must be vented to prevent accumulation of internal pressure.

(c) Hydrogen peroxide solution in water containing over 8 per cent hydrogen peroxide by weight and not exceeding 37 per cent must be packed in specification containers as prescribed in paragraphs (a), (b) or (f) of this section or as follows:

(1) Spec. 1A. Glass carboys. The cushioning must be incombustible mineral material, elastic wooden-strip packing, or large elastic cushions such as corks fastened securely in position. The use of hay, excelsior, ground cork, or similar material, whether treated or untreated, is prohibited. The carboy stoppers must be vented so as to prevent accumulation of internal pressure; use of cork gasket impregnated with paraffin is authorized.

(2) Spec. 1X. Boxed carboys; single-trip for export only are authorized to be transported to ship side by rail freight in carload lots only.

(3) Spec. 1D. Glass carboys in boxes or plywood drums of not over 5½ gallons nominal capacity. Means shall be provided so that accumulated pressure in bottle shall not exceed 10 psi. gauge at 130°F., or shall vent at a pressure not to exceed 10 psi. gauge. The cushioning must be incombustible mineral material, elastic wood-strip packing, or large elastic cushions such as corks fastened securely in position. The use of hay, excelsior, ground cork, or similar material, whether treated or untreated, is prohibited.

(4) Spec. 15A, 15B, 15C, 16A, 19A or 19B. Wooden boxes with inside containers of polyethylene, or other plastic material resistant to the lading, not over 1 pint capacity or 16 ounces by weight each. Inside containers must be securely cushioned with incombustible mineral matter, such as whiting, mineral wool, infusorial earth, asbestos, or sifted ashes.

(5) Spec. 1H, 15P, or 22C. Metal crate with inside polyethylene carboy; or glued plywood or wooden box, or plywood drum as prescribed by subparagraph 2(a) specification 22C with inside spec. 2T polyethylene container.

(6) Spec. 12B. Fibreboard boxes, with inside aluminum bottles constructed of at least 99 per cent pure aluminum of not over 5 pounds or 5 pints capacity each. Each bottle shall be individually partitioned and surrounded by incombustible mineral packing material in the outside shipping container. Bottle closure shall be by means of a threaded aluminum cap, fitted with polyethylene gasket or other equally efficient closing device. A venting device which will not leak liquid under conditions normally incident to transportation is permitted.

(8) Spec. 12B. Fibreboard boxes with inside polyethylene bottles not over 1 gallon capacity each with vented closures; such bottles over 1 quart capacity each must be completely contained in a securely closed polyethylene bag or tube constructed of material having minimum film thickness of 0.003 inch. Alkaline solutions containing sodium hydroxide or other alkaline materials packed in glass or polyethylene bottles not over 1 gallon capacity each and with hydrogen peroxide solution contained in polyethylene bottles not over 1 gallon capacity each, when shipped as a wood bleach preparation, may be packed together in inside chipboard or corrugated fibreboard boxes or separated by corrugated fibreboard partitions, not more than six inside chipboard or corrugated fibreboard boxes having inside bottles not over 1 quart each, or more than 4 one-gallon bottles separated by corrugated fibreboard partitions may be packed in one outside box; completed package with mixed contents must be capable of withstanding a drop from a height of four feet onto solid concrete without failure of any inside container.

(9) Spec. 12A. Fibreboard boxes with inside glass or polyethylene bottles, not over 1-gallon capacity each. Each bottle closure must be vented and each bottle completely contained in a securely closed polyethylene bag or tube constructed of material having minimum film thickness of 0.003 inch. Shipper must have established that completed package meets test requirements prescribed by Paragraph 10 of Spec. 12A.

(10) Spec. 16D. Wirebound wooden overwrap, with inside spec. 2T or 2TL polyethylene container.

(d) Hydrogen peroxide solution in water containing over 8 per cent hydrogen peroxide by weight and not exceeding 10 per cent must be packed in specification containers as prescribed in paragraphs (a), (b), (c) or (f) of this section.

(e) Hydrogen peroxide solution in water not exceeding 52 per cent hydrogen peroxide by weight, when shipped in tank cars, or portable tanks in carload quantities only, as not subject to any other requirement of these regulations.

(f) Hydrogen peroxide solution in water exceeding 52 per cent hydrogen peroxide by weight may also be packed in specification containers as follows:

(1) Spec. 103A-ALW or 111A60ALW2. Tank cars. Venting arrangements must be approved by the Director of Operation, R.T.C.

§ 73.267 Nitrating acid mixtures. (a) Nitrating acid mixtures, when offered for transportation by rail freight, must be packed in specification containers as follows:

(1) Spec. 15A, 15B, 15C, 16A, 19A or 19B. Wooden boxes with inside glass bottles not over 7 pounds capacity each, individually enclosed in tightly closed metal cans and cushioned therein with incombustible mineral material.

(2) Spec. 5C. Metal barrels or drums of Type 304 ELC or 347 stainless steel only. (See paragraph (b) of this section.)

(3) Spec. 103A[1], 103-A-W, 111A100-F-2, or 111A60W2 tank cars. (See paragraph (b) of this section.)

(4) Spec. 1A. Carboys in boxes. Authorized only for mixed nitric and sulphuric acid containing not over 17 per cent nitric acid and containing at least 33 per cent water. Straight-sided carboys must be used; cushioning must be incombustible mineral material, elastic wooden-strip packing, or large elastic cushions, such as cork, fastened securely in position. The use of hay, excelsior, ground cork, or similar material, whether treated or untreated, is prohibited.

(5) Spec. 1X. Boxed carboys of 4 to 5 gallons capacity; single-trip for export only are authorized to be transported to ship side by rail freight in carload lots only.

(6) Spec. 1D. Glass carboys in boxes or plywood drums of not over 5½ gallons nominal capacity; authorized only for mixed nitric and sulphuric acid, containing not over 17 per cent nitric acid and containing at least 33 per cent water; means shall be provided so that accumulated pressure in bottle shall not exceed 10 pounds per square inch gauge at 130°F., or vent at pressure not to exceed 10 pounds per square inch gauge. Cushioning must be incombustible mineral material, elastic wooden-strip packing, or large elastic cushions such as cork, fastened securely in position. The use of hay, excelsior, ground cork, or similar material, whether treated or untreated, is prohibited.

(8) Spec. 60. Portable tanks. (See paragraph (b) of this section.)

(9) Spec. 5A. Carbon steel barrels or drums. Authorized only for mixed acids containing less than 80 per cent nitric acid. (See paragraph (b) of this section.)

(b) Mixtures of sulphuric acid and nitric acid (nitrating acid), shipped in tank cars, or metal barrels or drums, shall contain not less than 10 per cent sulphuric acid. These mixtures may contain:

(1) Up to 10 per cent water with not less than 10 per cent sulphuric acid.

(2) Up to 15 per cent water with not less than 15 per cent sulphuric acid.

(3) Up to 20 per cent water with not less than 20 per cent sulphuric acid.

(4) Up to 38 per cent water with not less than 62 per cent sulphuric acid.

(c) mixed acid (nitric and sulphuric acid) (nitrating acid), when offered for transportation by rail express must be packed in specification containers as follows (also authorized for transportation by carriers by rail freight):

(1) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes with inside glass bottles with glass stoppers ground to fit, and these stoppers must be held in place by plaster of Paris covered by strong cloth securely tied. Glass bottles having necks with molded screw threads, must be closed by threaded-type acid-resistant plastic caps. Caps must be equipped with an elastic composition cushion and with glass, porcelain or similar liner which must be impervious to the acid. Such caps, when secured in place by at least one complete continuous thread, must be capable of preventing any leakage of the liquid.

(2) Or glass bottles having necks with molded screw threads must be closed by threaded-type acid-resistant caps. Caps must be lined with a resilient liner which must be impervious to the acid. Such caps, when secured in place by at least one complete continuous thread, must be capable of preventing any leakage of the acid.

(3) Each bottle must be placed in a tightly closed metal container and well cushioned therein on all sides with incombustible mineral packing material, such as whiting, mineral wool, infusorial earth (kieselguhr), asbestos, sifted ashes, or powdered china clay, etc. The metal container must be packed in the outside container, and well cushioned by incombustible mineral packing material as herein described.

(4) Not more than 3½ pounds (1¼ quarts) of mixed acid may be shipped in one outside package.

§ 73.268 Nitric acid. (a) Nitric acid exceeding 40 per cent concentration in any quantity must not be packed with any other article.

(b) Nitric acid in any concentration which does not contain significant quantities of sulphuric acid or hydrochloric acid as impurities, when offered for transportation by carriers by rail freight, must be packed in specification containers as follows:

(1) Spec. 103CW or 111A60W7. Tank cars.

(4) Spec. 5C. Metal barrels or drums. Authorized for concentrations of nitric acid as limited by paragraph 3(c) spec. 5C. Containers weighing less than 85 per cent of their original marked weight are not authorized.

(5) Containers as specified in paragraphs (c), (d), (e), and (f), and within percentage limitations of this section.

(6) Spec. 33A. Polystyrene case (nonreusable container) with inside glass bottles not over 5-pint capacity each. Not more than four 5-pint bottles may be packed in one outside packaging.

(c) Nitric acid of 80 per cent or greater concentration which does not contain significant quantities of sulphuric acid or hydrochloric acid as impurities, when offered for transportation by carriers by rail freight in addition to and within limitations of paragraphs (b), (d), and (e) of this section, may be packed in specification containers as follows:

(1) Spec. 42B. Aluminum drums.

(2) Spec. 103A-ALW or 111A60ALW2. Tank cars. Spec. 111A60ALW tank cars must have a safety relief valve start-to-discharge pressure setting of 45 pounds per square inch.

(d) Nitric acid of 90 per cent or greater concentration, when offered for transportation by carriers by rail freight in addition to and within limitations of paragraphs (b) and (c) of this section may be packed in specification containers as follows:

(1) Spec. 15A, 15B, 15C, 16A, 19A, 19B, 11A, or 11B. Wooden boxes, barrels and kegs with inside containers which must be glass bottles not over 5 pints capacity each, individually enclosed in tightly closed metal cans and cushioned therein with sufficient incombustible mineral material. (See paragraphs (g) and (h) of this section.)

(2) Spec. 105A100ALW. Tank cars. Tanks must be fabricated

[1] Use of existing tank cars authorized, but new construction not authorized.

of aluminum alloy which is compatible with the lading, and must be equipped with safety relief valves made of material which is not adversely affected by the lading.

(e) Nitric acid of concentration of less than 90 per cent, when offered for transportation by carriers by rail freight, in addition to and within limitations of paragraphs (b), (c), and (f) of this section, may be packed in specification containers as follows:

(1) Spec. 15A, 15B, 15C, 16A, 19A, 19B, 11A, or 11B. Wooden boxes, barrels and kegs with inside containers which must be glass bottles not over 5 pints capacity each. (See paragraphs (g) and (h) of this section.)

(f) Nitric acid of concentration of 72 per cent or less, when offered for transportation by carriers by rail freight, in addition to and within limitations of paragraphs (b) and (e) of this section, may be packed in specification containers as follows:

(1) Spec. 1A, or 1K. Straight sided carboys in boxes or kegs.

(2) Spec. 1X. Boxed carboys single-trip for export only are authorized to be transported to ship side by rail freight in carload lots only.

(3) Spec. 1D. Glass carboys in boxes or plywood drums of not over 5½ gallons nominal capacity. Means shall be provided so that accumulated pressure in bottle shall not exceed 10 pounds per square inch gauge at 130°F., or shall vent at a pressure not to exceed 10 pounds per square inch gauge.

(4) Cushioning for carboys must be incombustible mineral material, elastic wooden strips, natural cork blocks or rubber blocks. The use of hay, excelsior, loose ground cork, or similar materials, whether treated or untreated, is prohibited.

(5) Spec. 60. Portable tanks, glass-lined.

(6) Spec. 33A. Polystyrene cases (nonreusable container) with inside glass bottles not over 2 quarts capacity each. Not more than four 2-quart bottles may be packed in one outside container.

(7) Spec. 12R. Paper-faced expanded polystyrene board boxes with inside glass bottles not over 2 quarts capacity each. Not more than six 2-quart bottles shall be packed in one outside shipping container.

(g) Closures for bottles. Glass stoppers ground to fit and held in place by plaster of Paris covered by a strong cloth securely tied; or:

(1) Threaded-type acid-resistant caps with gasket or lining impervious to the acid and sufficiently resilient, or cushioned, to give an acidproof closure; at least 1 complete continuous thread is required to be engaged when bottle is closed for shipment.

(h) Cushioning inside containers. Inside containers must be well cushioned. Except as provided in subparagraph (1) of this paragraph, all material for cushioning must be incombustible mineral material such as whiting, mineral wool, infusorial earth, asbestos, sifted ashes, etc. The use of hay, excelsior, ground cork, or similar material, whether treated or untreated, is prohibited. Where the cushioning material is very fine or powdery, separate partitions for the individual inside containers shall be provided to prevent the bottles from shifting and coming in contact with each other, and the box must be tight to prevent sifting of cushioning material.

(1) Cushioning of inside containers in outside specification wooden boxes by means of elastic packings, such as wooden strips, large corks, or pads formed of an expanded polystyrene resin that is resistant to the action of nitric acid, fastened securely in position, is authorized if the completed package will pass the swing test prescribed for boxed carboys.

(i) Nitric acid of any concentration, when offered for transportation by rail express must be packed in specification containers as follows (also authorized for transportation by carriers by rail freight):

(1) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes with inside glass bottles with glass stoppers ground to fit, and these stoppers must be held in place by plaster of Paris covered by strong cloth securely tied. Glass bottles having necks with molded screw threads, must be closed by threaded type acid-resistant plastic caps. Caps must be equipped with an elastic composition cushion and with glass, porcelain or similar liner which must be impervious to the acid. Such caps, when secured in place by at least one complete continuous thread, must be capable of preventing any leakage of the acid.

(2) Or glass bottles having necks with molded screw threads must be closed by thread-type acid-resistant caps. Caps must be lined with a resilient liner which must be impervious to the acid. Such caps, when secured in place by at least one complete continuous thread, must be capable of preventing any leakage of the acid.

(3) Each bottle must be placed in a tightly closed metal container, and well cushioned therein on all sides with incombustible mineral packing material, such as whiting, mineral wool, infusorial earth (kieselguhr), asbestos, sifted ashes, or powdered china clay, etc. The metal container must be packed in outside containers, and well cushioned by incombustible mineral packing material as described in this section.

(4) Not more than 5 pints of nitric acid shall be shipped in one outside package.

(j) Nitric acid of not over 50 per cent concentration, when offered for transportation by rail express, may in addition to the provisions of paragraph (i) of this section be packed in specification containers as follows (also authorized for transportation by carriers by rail freight):

(1) Spec. 15A, 15B, 15C, 16A, 19A, 19B, or 12B. Wooden or fibreboard boxes with not over 12 inside glass ampoules having capacity not over 4 fluid ounces each. Each glass ampoule must be well cushioned with incombustible mineral packing material, such as vermiculite or other equally efficient material, and be packed in a cylindrical cardboard tube having wall thickness of at least ⅛ inch, with the inside coated with wax, and be equipped with metal bottom and with metal screw-cap top. The inside packages must be separated by efficient means.

§ 73.269 Perchloric acid. (a) Perchloric acid in excess of 72 per cent must not be shipped by rail freight or rail express. When not exceeding 72 per cent strength must be packed in specification containers as follows:

(1) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes with glass inside containers consisting of glass bottles not over 5 pints capacity each, cushioned with incombustible mineral material in amount sufficient to absorb the acid.

(2) Spec. 1A, 1D, or 1K. Glass carboys in boxes, kegs or plywood drums.

(3) Spec. 1X. Boxed carboys; single-trip for export only are authorized to be transported to ship side by rail freight in carload lots only.

(4) Spec. 33A. Polystyrene cases (nonreusable container) with

inside glass bottles not over 5 pints capacity each. Not more than four 5-pint bottles may be packed in one outside container.

(5) Spec. 12R. Paper-faced expanded polystyrene board boxes with inside glass bottles not over 5 pints capacity each. Not more than six 5-pint bottles shall be packed in one outside shipping container.

(6) Spec. 6D. Cylindrical steel overpack with inside spec. 2S polyethylene container not exceeding 25 gallon capacity. Maximum net weight may not exceed 380 pounds.

(8) Spec. 34. Polyethylene drum. Authorized for perchloric acid not exceeding 50% strength only. The shipper shall assure conformance with the requirements of § 73.24(e) of this part prior to first shipment.

(b) cushioning for carboys must be incombustible mineral material, elastic wooden strips, natural cork blocks or rubber blocks. The use of hay, excelsior, loose ground cork, or similar materials, whether treated or untreated, is prohibited.

(c) Perchloric acid in any quantity must not be packed with any other article.

(d) Closures for bottles. Required as follows:

(1) Glass stoppers ground to fit and held in place by plaster of Paris covered by a strong cloth securely tied.

(2) Threaded-type acid-resistant caps with a gasket or lining impervious to the acid and sufficiently resilient, or cushioned, to give an acid-proof closure; at least one complete continuous thread is required to be engaged when bottle is closed for shipment.

(e) Inside containers must be well cushioned. All material for cushioning must be incombustible mineral material, such as whiting, mineral wool, infusorial earth (kieselguhr), asbestos, sifted ashes, or powdered china clay, etc. The use of hay, excelsior, ground cork, or similar material, either treated or untreated, is prohibited. Where the cushioning material is very fine or powdery, separate partitions for the individual inside containers should be provided to prevent the bottles from shifting and coming in contact with each other, and the box must be tight to prevent sifting of cushioning material.

(1) Cushioning of inside containers in outside wooden boxes by means of elastic packings, such as wooden strips, large corks, or pads formed of an expanded polystyrene resin that is resistant to the action of perchloric acid, fastened securely in position, is authorized if the completed package will pass the swing test prescribed for boxed carboys.

§ 73.270 Phosphorus tribromide. (a) Phosphorus tribromide must be packed in specification containers as follows:

(2) Spec. 11A or 11B. Wooden barrels or kegs with glass or earthenware inside containers not over 2 gallons each; the glass or earthenware containers must be cushioned in the outside containers by means of incombustible elastic packing material of such nature that a mixture of the liquid and the packing material will not cause fires or heating.

(3) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes with glass or earthenware inside containers not over 1 gallon each, except that inside containers up to 3 gallons each are authorized when only one is packed in an outside container.

(5) Spec. 5K or 5M. Nickel or Monel drums not over 8½ gallons capacity each.

§ 73.271 Phosphorus oxychloride, phosphorus oxybromide, phosphorus trichloride, and thiophosphoryl chloride. (a) Phosphorus oxychloride, phosphorus oxybromide, phosphorus trichloride, and thiophosphoryl chloride must be packed in specification containers as follows:

(1) Spec. 34. Polyethylene drum. Authorized for phosphorus oxychloride only. The shipper shall assure conformance with the requirements of § 73.24(e) of this part prior to first shipment.

(2) Spec. 5K. Nickel drums.

(3) Spec. 11A or 11B. Wooden barrels or kegs with glass or earthenware inside containers not over 2 gallons each; the glass or earthenware containers must be cushioned in the outside containers by means of incombustible elastic packing material of such nature that a mixture of the liquid and the packing material will not cause fires or heating.

(4) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes with glass or earthenware inside containers not over 1 gallon each, except that inside containers up to 3 gallons each are authorized when only one is packed in an outside container.

(5) Spec. 6D. Cylindrical steel overpack with inside Spec. 2S or 2SL polyethylene packaging. Polyethylene used must be Type III. Authorized for phosphorus oxychloride and thiophosphoryl chloride only.

(6) Spec. 60. Portable tanks when tanks are lead-lined.

(7) Spec. 103A-N-W. Tank cars. Tank must be of solid nickel at least 99 per cent pure and all cast metal parts of the tank in contact with the lading have a minimum nickel content of approximately 96.7 per cent.

(9) Spec. 103A[1], 103A-W, 111A100-F-2, or 111A60W2 tank cars. Spec. 103A[1] tanks must be lead-lined steel or made of steel at least 10 per cent nickel clad. Spec. 103A-W, 111A100-F-2, or 111A60W2 tanks must be lead-lined steel or made of steel with a minimum thickness of nickel cladding 1/16 inch. Nickel cladding in tanks must have a minimum nickel content of at least 99 per cent pure nickel.

(10) Spec 103E-W. Tank cars made from type 316 stainless steel. Authorized for phosphorus trichloride and thiophosphoryl chloride only.

(11) Spec. 103A[1], 103AW, 103CW, 111A60W2, or 111A100F2. Tank cars. Spec. 103CW must be fabricated from type 430 stainless steel. Authorized for phosphorus trichloride only.

(12) Spec. 5A or 5C. Metal barrels or drums. Authorized for phosphorus trichloride and thiophosphoryl chloride.

(16) Spec. 17C. Metal drums (single-trip) with no opening exceeding 2.3 inches in diameter. When drums are not constructed of stainless steel they must be lined with a material impervious to the lading. Authorized for phosphorus trichloride only.

(17) Spec. 5M. Monel drums over 8½ gallons capacity each.

(18) Spec. 5B. Metal barrels or drums lined with a material which is compatible with the commodity. Authorized for thiophosphoryl chloride only.

§ 73.272 Sulphuric acid. (a) Sulphuric acid (oleum, oil of vitriol, etc.) must be packed in specification containers as follows:

(b) Sulphuric acid solutions of not over 25 per cent concentrations, in inside containers of not more than 8 ounces capacity each, resistant to the lading, packed in strong outside containers and cushioned with absorbent material in sufficient quantity to completely absorb liquid contents in event of breakage,

[1] Use of existing tank cars authorized, but new construction not authorized.

are exempt from specification packaging requirements for transportation by rail freight or rail express.

(c) Sulphuric acid concentration of 51 per cent or less: Authorized packaging is described in subparagraphs (1) through (16) and (24) through (26) of paragraph (i) of this section.

(d) Sulphuric acid concentration of greater than 51 per cent to not over 65.25 per cent: Authorized packaging is described in subparagraphs (1) through (16) and (27) of paragraph (i) of this section.

(e) Sulphuric acid concentration of greater than 65.25 per cent to not over 77.5 per cent: Authorized packaging is described in subparagraphs (1) through (16) and (20) through (22) of paragraph (i) of this section.

(f) Sulphuric acid concentration of greater than 77.5 per cent to not over 95 per cent: Authorized packaging is described in subparagraphs (1) through (22) of paragraph (i) of this section.

(g) Sulphuric acid concentration of greater than 95 per cent to not over 100.5 per cent: Authorized packaging is described in subparagraphs (1) through (4), (6), (9) and (14) through (22) of paragraph (i) of this section.

(h) Sulphuric acid concentration of greater than 100.5 per cent: Authorized packaging is described in subparagraphs (1) through (4), (17), and (19) through (23) of paragraph (i) of this section.

(i) Authorized packagings are described as follows:

(1) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes with glass inside containers, not over 1 gallon capacity each, except that a glass inside container up to 2.5 gallons capacity may be used if only one container is packed in each outside wooden box.

(2) Spec. 12A. Fibreboard boxes with inside glass bottles not over 2 quarts capacity each. Not more than six 2-quart glass bottles may be packed in one outside container. Shipper must have established that the completed package meets the test requirements prescribed in § 10.

(3) Spec. 33A. Polystyrene cases (nonreusable container) with inside glass bottles not over 2 quarts capacity each. Not more than four 2-quart bottles may be packed in one outside container.

(4) Spec. 1X. Boxed carboys; single-trip for export only. For shipment by water to foreign countries; shipments from inland points which are consigned to such destinations are authorized to be transported to ship side by rail freight in carload lots only.

(5) Spec. 1H, 15P, or 22C. Metal crate with an inside polyethylene carboy; or glued plywood or wooden box, or plywood drum as prescribed by 2(a) of 22C with an inside specification 2T or 2TL polyethylene container.

(6) Spec. 6D or 37M (nonreusable container). Cylindrical steel overpacks with an inside specification 2S, 2SL, or 2T polyethylene container. Overpack of 45-gallon capacity must be constructed of at least 16-gauge steel throughout when used for sulphuric acid of 93 per cent or greater concentration.

(7) Spec. 16D. Wirebound wooden overrap, with an inside specification 2T, 2TL, 2S, or 2SL polyethylene container.

(8) Spec. 21P. Fibre drum overpack with an inside specification 2T or 2U polyethylene container not over 12 gallon capacity.

(9) Spec. 34. Polyethylene drum.

(10) Spec. 16A. Wirebound wooden box (see § 22) with an inside specification 2U polyethylene container. The polyethylene container must be separated from the wooden box by a complete corrugated fibreboard liner and top and bottom pads.

(11) Spec. 12P. Fibreboard box with one inside Spec. 2U polyethylene container of not over 5 gallon capacity, or two inside spec. 2U polyethylene containers of not over 2½ gallon capacity each. Wire staples are not authorized for assembly or closure of boxes, except when polyethylene container is completely enclosed in an inside box free of wire staples or other projections that could cause failures.

(12) Spec. 12B. Fibreboard boxes with inside polyethylene containers or other containers of plastic compatible with the chemical, not over 1-gallon capacity each. Inside containers must be cushioned to prevent movement in the outside box. Not more than four 1-gallon inside containers may be packed in one outside container. Authorized gross weight not over 75 pounds.

(13) Spec. 12R. Paperfaced expanded polystyrene board boxes with inside specification 2E polyethylene bottles not over 1-gallon capacity each. Not more than four 1-gallon polyethylene bottles may be packed in one outside packaging.

(14) Spec. 12R. Paperfaced expanded polystyrene board boxes with inside glass bottles not over 2 quarts capacity each. Not more than six 2-quart bottles may be packed in one outside shipping container.

(15) Spec. 1A, or 1K. Carboys in boxes or kegs.

(16) Spec. 1D. Glass carboys in boxes or plywood drums, of not over 5.2 gallons nominal capacity.

(17) Spec. 5A. Metal barrels or drums. Authorized for sulphuric acid of 77.5 per cent or greater concentrations, with or without an inhibitor, provided such acid has a corrosive effect on steel no greater than 93.2 per cent sulphuric acid, measured at 100°F.

NOTE 1: Tapered steel plugs, without gaskets, for standard specification 5A flanges are authorized. Threaded length must not be less than 1.5 inches. Major diameter of plug must not be over $2^{11}/_{32}$ inches, and minor diameter not less than $2^{7}/_{32}$ inches

(18) Spec. 17F. Metal barrels or drums (single-trip only). Drums equipped with vented closures of an experimental type approved by the Director of Operation, R.T.C. are also authorized for export shipments. Authorized for sulphuric acid of 77.5 per cent to 98 per cent concentrations with or without an inhibitor, provided such acid has a corrosive effect on steel no greater than 93.2 per cent sulphuric acid measured at 100°F.

(19) Spec. 5C. Metal barrels or drums of Type 304, 316, or 347 stainless steel or other types of stainless steel of at least equivalent corrosion resistance and physical properties. Authorized for sulphuric acid of 93 per cent or greater concentrations.

(20) Spec. 60. Portable tank. Authorized for sulphuric acid of 65.25 per cent or greater concentrations provided the corrosive effect in steel is not greater than that of 65.25 per cent sulphuric acid, measured at 100°F.

(22) Spec. 103A[1], 103AW, 103CW, 105A300W, 111A60W2, 111A100W6, or 111A100F2. Tank cars. Authorized for sulphuric acid of concentrations 65.25 percent or greater, provided the corrosive effect in steel is not greater than that of 65.25 percent sulphuric acid, measured at 100°F. Spec. 103CW and 111A100W6 tank cars must have tanks constructed of type 304-L stainless steel. Bottom outlets are not authorized.

(23) Spec. 115A60W6. Tank cars. Tanks must be constructed of type 304 or 316 stainless steel. Bottom outlets must be ren-

[1] Use of existing tank cars authorized, but new construction not authorized.

dered inoperative and blanked off.

(24) Spec. 60. Rubber-lined portable tanks.

(26) Spec. 103B[1], 103BW, or 111A60W5. Lined tank cars.

(27) Spec. 103AW, 111A100F2 or 111A60W2. Tank cars having tanks equipped with a phenolic lining impervious to the lading.

(j) (Cancelled).

(k) (Cancelled).

§ 73.273 Sulphur trioxide, stabilized. (a) Sulphur trioxide, stabilized, must be packed in specification containers as follows:

(1) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes with glass or earthenware inside containers not over 1 gallon each.

(2) Spec. 5A or 5C. Metal barrels or drum, not over 46 gallons capacity each.

(3) Spec. 17F. Metal drums (single-trip).

(4) Spec. 103A[1], 103AW, 105A100W, 111A60W2, or 111A100F2. Tank cars. Authorized only for stabilized sulphur trioxide. Tank cars shall have safety valves of approved design and not subject to rapid deterioration by the lading. Cars equipped with interior heater coils not permitted.

§ 73.274 Fluosulphonic acid. (a) Fluosulphonic acid must be packed in containers as follows:

(1) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes with inside containers which must be not over 1 gallon each, except that inside containers up to 3 gallons are authorized when only one is packed in each outside container, as prescribed in Notes 1 and 2 of this section.

NOTE 1: Bottles manufactured of Pyrex glass or glass of equal acid resistance, authorized only for material containing an excess of sulphur trioxide, with Pyrex glass stoppers, or glass stoppers of equal acid resistance ground to fit and held in place by plaster of Paris covered by strong cloth securely tied; each bottle must be placed in a metal container, well cushioned therin with incombustible absorbent materials such as mineral wool, infusorial earth (kieselguhr), asbestos, etc.

NOTE 2: Or steel containers, 14 gauge steel throughout, welded heads and side seams, equipped with ¾ inch welded flange and plug. Threads for plug must be 8 or less per inch. Each drum must be tested for leakage with 15 pounds hydrostatic pressure.

(2) Spec. 5A or 17F (single-trip). Metal barrels or drums not over 46 gallons capacity each.

(3) Spec. 103A[1], 103A-W, 111A100-F-2, or 111A60W2 tank cars.

§ 73.275 Difluorophoshoric acid, anhydrous, fluorophosphoric acid, anhydrous, hexafluorophosphoric acid, and mixtures thereof. (a) Difluorophoshoric acid, anhydrous, fluorophosphoric acid, anhydrous, hexafluorophosphoric acid, and mixtures thereof must be packed in specification containers as follows:

(1) Spec. 15A, 15B, 15C, 16A, 19A, or 19B wooden boxes, Spec. 12B fibreboard boxes, or spec. 21C fibre drums with inside containers which must be polyethylene, or other non-fragile plastic bottles resistant to the lading, not over 2 gallons capacity each, closed by means of threaded acid-resistant caps; caps must have at least one complete continuous thread and be additionally sealed to the bottle to prevent turning of cap after bottle is closed for shipment.

(2) Spec. 42B, 42C, or 42D. Aluminum drums not over 46 gallons capacity.

(3) Spec. 22C. Plywood drum as prescribed by subparagraph 2(a) Specification 22C, with inside spec. 2T polyethylene container.

(4) Spec. 60. Portable tanks. Authorized for inhibited acids enumerated in paragraph (a) only.

(5) Spec. 6D. Cylindrical steel overpack with inside spec. 2S or 2SL polyethylene packaging. Net weight may not exceed 550 pounds.

(b) Inside containers must be packed so they cannot change position in the outside container while in transit and inert absorbent cushioning material must be used where necessary.

§ 73.276 Anhydrous hydrazine and hydrazine solution. (a) Anhydrous hydrazine and hydrazine solution containing 50 per cent or less of water must be packed in specification containers as follows:

(1) Spec. 1D. Boxed glass carboys.

(2) Spec. 15A, 15B, 15C, 19A, or 19B. Wooden boxes with inside containers which must consist of glass bottles not exceeding 1-gallon capacity each, cushioned by means of vermiculite within tin cans which shall be tightly closed.

(3) Spec. 5, 5A, 5C, or 17E (single-trip). Metal barrels or drums which shall be of type 304 or 347 stainless steel, with openings not exceeding 2.3 inches in diameter.

(4) spec. 103C-W, 111A60W7, or 111A100W6. Tank cars having tanks of Type 304L or 347 stainless steel with molybdenum content not exceeding one-half of 1 per cent. The safety relief valve on specification 103C-W tank car tanks may have a start-to-discharge pressure of not more than 45 psi. in place of 35 psi. Specification 111A100W6 tanks must not be equipped with bottom outlets. Vapour space in tanks must be filled with nitrogen gas at atmospheric pressure. Bottom washout permitted.

(5) Spec. 103-A-ALW. Tank cars. The safety relief valve on tanks may have a start-to-discharge presssure of not more than 45 psi. in place of 35 psi. Vapour space in tanks must be filled with nitrogen gas at atmospheric pressure. Authorized for anhydrous hydrazine only.

(7) Spec. 37M (nonreusable container). Cylindrical steel over pack with inside spec. 2SL polyethylene container. Authorized for hydrazine solution only.

(8) Spec. 42B, 42C, or 42D aluminum drums. Authorized for anhydrous hydrazine only.

(9) Spec. 12B. Fibreboard box with one inside Spec. 2E polyethylene bottle not over 4½-quart capacity. Polyethylene bottle must be of Type III high density polyethylene having a minimum wall thickness of 30 mils and bottle must be securely closed with a screw cap. Authorized for hydrazine solution only.

(10) Spec. 34. Polyethylene drum. Authorized for hydrazine solution only.

(12)Spec. 57. Stainless steel portable tank. Authorized for hydrazine, aqueous solution only.

§ 73.277 Hypochlorite solutions. (a) Hypochlorite solutions containing more than 7 per cent available chlorine by weight must be packed in specification containers as follows:

(1) Spec. 15A, 15B, 15C, 19A, or 19B. Wooden boxes or Spec. 12A or 12B fibreboard boxes with inside glass, earthenware or polyethylene packagings of not more than 1 gallon capacity each. Gross weight must not exceed 65 pounds nor contain more than 4 glass or earthenware inside packagings if their capacity is greater than 5 pints each, or more than six such polyethylene packagings.

(2) Spec. 1A, or 1D. Glass carboys in boxes, kegs, or ply-

[1] Use of existing tank cars authorized, but new construction not authorized.

wood drums.

(3) Spec. 1H, 15P, or 22C. Metal crate with inside polyethylene carboy; or glued plywood or wooden box, or plywood drum as prescribed by subparagraph 2(a) specification 22C, with inside spec. 2T polyethylene container. Spec. 15P glued plywood or wooden box may contain spec. 2S polyethylene drum. Authorized for not over 16 per cent sodium hypochlorite solution only.

(4) Spec. 6D or 37M (nonreusable container). Cylindrical steel overpacks with inside specification 2S or 2SL polyethylene liners. Authorized for not over 16 per cent sodium hypochlorite solution only.

(5) Spec. 12P. Fibreboard boxes with one inside spec. 2U polyethylene container of not over 5 gallon capacity or two inside spec. 2U polyethylene containers of not over 2½ gallon capacity each. Wire staples are not authorized for assembly or closure of boxes, except when polyethylene container is completely enclosed in inside boxes free of wire staples or other projections that could cause failures.

(6) Spec. 34. Polyethylene container. Authorized for not over 16 per cent sodium hypochlorite solution only.

(7) Spec. 21P. Fibre drum overpack with inside Spec. 2S, 2SL, 2T, or 2U polyethylene container. Authorized for not over 16 percent sodium hypochlorite solutions only.

(8) Spec. 37P. Steel drums with polyethylene liner (nonreusable container). Containers must be vented to prevent accumulation of pressure. Authorized for not over 16 percent solutions of sodium hypochlorite only.

(b) Closures for inside containers and carboys must be vented and must be of a material resistant to the lading and capable of preventing leakage of liquid contents.

(c) Spec. 57. Steel portable tank. Authorized for not over 15 percent solutions of sodium hypochlorite only. Tanks constructed of a steel other than stainless steel must have a polyethylene liner impervious to the solution. Vented closures are authorized.

(d) Glass or earthenware containers of not more than 4 fluid ounces capacity each, packed in strong outside containers, and cushioned with absorbent material in sufficient quantity to completely absorb liquid contents in the event of breakage, are exempt from specification packaging requirements, for transportation by rail freight or rail express.

(1) Polyethylene pouches not over 2½ ounces capacity each, heat sealed, and formed of polyethylene, or other suitable plastic, not less than .0035 inch in thickness to which shall be laminated a .0015 inch, 25-pound basis weight white sulphate paper, when securely packed not more than 144 pouches in a strong fibreboard box (absorbent cushioning material not required), are exempt from specification packaging requirements.

§ 73.278 Nitrohydrochloric acid. (a) Nitrohydrochloric acid, which is a mixture of nitric acid not over 1.42 specific gravity and hydrochloric acid not over 1.19 specific gravity in the approximate proportions of one part nitric acid and three parts hydrochloric acid, must be packed in specification containers as follows:

(1)Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes with glass inside containers of not over 5 pints capacity each, individually enclosed in tightly closed metal cans and cushioned therin with sufficient incombustible mineral material.

(b) Nitrohydrochloric acid diluted, is a solution of nitrohydrochloric acid as described in paragraph (a) of this section, which has been diluted to not less than five times the volume of water and must be packed in specification containers as follows:

(1) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes with glass inside containers of not over 5 pints capacity each, individually enclosed in tightly closed metal cans and cushioned therein with sufficient incombustible mineral material.

(2) Spec. 1A, 1D. Glass carboys in boxes or plywood drums, not over 5 gallons nominal capacity for spec. 1A and not over 5½ gallons nominal capacity for spec. 1D and 1E.

§ 73.279 Anisoyl chloride. (a) Anisoyl chloride must be packed in specification containers as follows:

(1) Spec. 5C. Metal barrels or drums.

(2) spec. 5. Metal barrels or drums of stainless steel only, with flanges for closures welded in place and having no opening exceeding 2.3 inches in diameter.

(b) Inside containers of not more than 8-fluid ounces capacity each, resistant to lading, packed in strong outside containers, and cushioned with absorbent material in sufficient quantity to completely absorb liquid contents in the event of breakage, are exempt from specification packaging requirements for transportation by rail freight or rail express.

§ 73.280 Allyl trichlorosilane, amyl trichlorosilane, butyl trichlorosilane, cyclohexenyl trichlorosilane, cyclohexyl trichlorosilane, dichlorophenyl trichlorosilane, diethyl dichlorosilane, diphenyl dichlorosilane, dodecyl trichlorosilane, ethyl phenyl dichlorosilane, hexadecyl trichlorosilane, hexyl trichlorosilane, nonyl trichlorosilane, octadecyl trichlorosilane, octyl trichlorosilane, phenyl trichlorosilane, propyl trichlorosilane, and chlorophenyl trichlorosilane. (a) Allyl trichlorosilane, amyl trichlorosilane, butyl trichlorosilane, cyclohexenyl trichlorosilane, cyclohexyl trichlorosilane, dichlorophenyl trichlorosilane, diethyl dichlorosilane, diphenyl dichlorosilane, dodecyl trichlorosilane, ethyl phenyl dichlorosilane, hexadecyl trichlorosilane, hexyl trichlorosilane, nonyl trichlorosilane, octadecyl trichlorosilane, octyl trichlorosilane, phenyl trichlorosilane, propyl trichlorosilane, and chlorophenyl trichlorosilane must be packed in specification containers as follows:

(1) Spec. 15A, 16B, or 19B. Wooden boxes with glass inside containers not over 1 gallon capacity each securely closed and cushioned with incombustible absorbent material.

(2) Spec. 17H or 37A. Metal drums (single-trip), with glass inside containers not over 1 gallon capacity each securely closed and cushioned with incombustible absorbent material.

(3) Spec. 5A. Metal drums not over 46 gallons capacity.

(5) Spec. 5, 5B, 5C, and 17E single-trip. Metal drums. These containers not authorized for shipments by rail express.

(6) Specification cylinders as prescribed for any compressed gas, except acetylene.

(7) Spec. 103W, 103A[1], 103AW, 105A100[1], 105A100W, 111A60F1, 111A60W1, 111A100F2, 111A60W2, or 111A100W4 tank cars.

§ 73.281 Benzyl bromide (bromotoluene, alpha). (a) Benzyl bromide (bromotoluene, alpha) must be packed in specification containers as follows:

(1) Spec. 15A, 15B, 15C, or 19B. Wooden boxes with inside

[1] Use of existing tank cars authorized, but new construction not authorized.

containers which must be glass bottles, not over 1 gallon capacity each, closed by means of screw caps which are resistant to action of the contents, bottles must be packed in metal cans having slip-on or friction closure; cans must be cushioned in outside boxes with incombustible material.

(2) Spec. 5K or 5M. Nickel or monel barrels or drums. spec. 5M drums shall not be over 8½ gallons capacity.

§ 73.283 Fluoboric acid. (a) Fluoboric acid exceeding 50 per cent concentration shall be packed as prescribed in § 73.264(a) for hydrofluoric acid.

(b) Fluoboric acid of 50 per cent concentration or less shall be packed as follows:

(1) In packagings prescribed in paragraph § 73.283(a), or

(2) In packagings prescribed in §73.245(a)(12), (16), (18), (19), (21), (24), or (26)

§ 73.284 Tungsten hexafluoride. (a) Tungsten hexafluoride shall be packed in Specification 3A, 3AA, 3BN, or 3E cylinders. These cylinders shall be equipped with a valve protection cap or be packed in a strong outside container adequate to protect the valves. Outlets of any valves shall be capped or plugged. The cylinder opening may be closed by the use of a metal plug. Specification 3E cylinders shall be shipped in an overpack.

§ 73.287 Chromic acid solution. (a) For the purposes of the regulations, a chromic acid solution is a solution of chromic acid (chromium trioxide) in water, with or without other acids, containing 35 per cent or more of chromic acid by weight. (For solutions containing less than 35 per cent chromic acid, see paragraph (c) of this section.) Packagings authorized must be of a design and be constructed of materials that will not react dangerously with or be decomposed by the chemical solution packaged therein.

(b) Chromic acid solutions must be packaged in specification containers as follows:

(1) Spec. 1A. Glass carboy in a box.

(2) Spec. 5, 5A, 5B. Metal barrel or drum with openings not exceeding 2.3 inches in diameter. Authorized for solutions containing chromic acid only.

(3) Spec. 17E steel drum. Authorized for solutions containing chromic acid only.

(4) Spec. 12A or 12B. Fibreboard box with one inside glass container not over 4 fluid ounces capacity, packed in a wax-lined cylindrical fibre carton with metal ends. The bottle closure must consist of a tightly secured, fitted, ground glass stopper. Space must remain between the bottle and the inner surface of the fibre cylinder and must be filled with closely packed asbestos in sufficient quantity to completely absorb the contents of the bottle in the event of breakage. Not authorized for solutions containing nitric acid.

(5) Spec. 12R. Paper-faced expanded polystyrene board box with inside glass bottles not over 5 pints capacity each. Not more than six 5-pint bottles may be packaged in one box. Each bottle must be well cushioned. Partitioning and cushioning must be provided to prevent bottles from shifting, or coming in contact with each other, the box wall, or the bottom. Each bottle closure must consist of a tightly secured, fitted ground glass stopper, or a threaded-type, acid-resistant cap with a gasket or lining impervious to the acid, sufficiently resilient or cushioned to give an acid-proof leakproof closure.

(6) Spec. 33A. Polystyrene case (nonreusable container) with inside glass bottles not over 5 pints capacity each. Not more than four 5-pint bottles may be packaged in one outside container. Each bottle closure must consist of a tightly secured, fitted, ground glass stopper, or a threaded-type, acid-resistant cap with a gasket of lining impervious to the acid, sufficiently resilient or cushioned to give an acidproof, leakproof closure.

(7) Spec. 29. Mailing tube with glass bottles not over 1 ounce capacity each. Each bottle must be well cushioned. Partitioning and cushioning must be provided to prevent bottles from shifting or coming in contact with each other or the tube wall, bottom, or top.

(9) Spec. 34. Polyethylene drum. The shipper shall assure conformance with the requirements of § 73.24(e) of this part prior to first shipment.

(c) Solutions containing chromic acid in water in concentration not exceeding 35 per cent by weight, with or without other acids, and which are not otherwise regulated by Subpart E of this part. In addition to the packaging and the limitation prescribed therefor in paragraph (b) of this section, solution of this composition may also be packaged as follows:

(1) In packaging as prescribed in § 73.245, except (a)(4), (14), (15), (18), (19) and (24).

(2) Spec. 21P. Fibre drum overpack with inside specification 2S or 2SL polyethylene container.

(3) Spec. 5, 5A, 5B. Metal barrel or drum with openings not exceeding 2.3 inches in diameter. Authorized for solutions containing chromic acid only.

(4) Spec. 17E steel drum. Authorized for solutions containing chromic acid only.

§ 73.288 Allyl chloroformate, benzyl chloroformate, ethyl chloroformate, and methyl chloroformate. (a) Allyl chloroformate, benzyl chloroformate, ethyl chloroformate, and methyl chloroformate must be packed in specification containers as follows:

(1) Spec. 15A, 15B, 15C, or 19B. Wooden boxes with glass inside containers not over 1 pint each, cushioned with incombustible mineral material.

(2) Spec. 1A. Boxed carboys. Glass bottles having nominal capacity of 3 gallons also authorized when packed and tested in accordance with requirements of spec. 1A; necks must be protected during shipment.

(b) Allyl chloroformate may, in addition, be packed in specification 5H lead-lined metal drums not over 46 gallons capacity.

(c) Spec. 16D. Wooden wirebound overwrap having one inside spec. 2SL polyethylene container not over 46 gallons capacity. Authorized for ethyl chloroformate or methyl chloroformate only.

(d) Spec. 6D or 37M. Cylindrical steel overpack with inside spec. 2S, 2SL, or 2T polyethylene container. Authorized for ethyl chloroformate and methyl chloroformate only.

(e) Spec. 34. Polyethylene drum.

(f) Spec. 111A100W2, 111A100W4, 112A200W, or 112A400F. Tank cars. Authorized only for ethyl chloroformate and methyl chloroformate.

§ 73.289 Formic acid and formic acid solutions. (a) Formic acid and formic acid solutions must be packed in specification containers as follows:

Use of existing tank cars authorized, but new construction not authorized.

(1) In containers prescribed in § 73.245, except spec. 5A, 17C, 17E or 17F. Metal barrels or drums.

(2) Spec. 103ALW, 103CW, 103EW, 111A60ALW, or 111A100W6. Tank cars. Spec. 103EW tanks must be of Type 316 stainless steel. Spec. 111A100W6 tanks must be of Type 304L or 316L stainless steel. Spec. 103ALW tanks without bottom outlets and Spec. 111A60ALW tanks are authorized only for concentrations of 97 percent or greater and must be equipped with top loading and unloading devices. Spec. 111A100W6 tanks are authorized only for concentrations of 80 percent or greater, must have bottom outlets effectively sealed, and must be equipped with top loading and unloading devices.

(5) Spec. 5C. Metal barrels or drums.

(6) Spec. 5. Metal barrels or drums of stainless steel only, with flanges for closures welded in place and having no opening exceeding 2.3 inches in diameter.

(7) Spec. 17H. Metal drums (single-trip) equipped with bag type liners of material and construction approved by the Director of Operation, R.T.C.. Each drum must have two diametrically opposite vent holes 1/4 inch diameter in the side wall at each end on close proximity to the top curl and the bottom chime. Interior of welded side seam must be covered or otherwise treated to provide a non-abrasive surface.

(8) Spec. 60. Portable tanks.

(9) Spec. 1EX. Carboys in plywood drums.

(10) Spec. 1H. Metal crate with inside polyethylene carboy.

§ 73.290 Mixtures of hydrofluoric and sulphuric acid. (a) Mixtures of hydrofluoric acid and sulphuric acid, containing not more than 80 per cent by weight and not less than 70 per cent by weight of hydrofluoric acid and sulphuric acid combined, with the hydrofluoric acid content not less than 25 per cent by weight in any case, must be packed in specification containers as follows:

(1) Spec. 5A. Unlined metal barrels or drums which have been subjected to an adequate passivation or neutralization process (see Note 1). Containers must be filled to not over 80 per cent of capacity at 68°F. If containers are washed out with water, they must be repassivated before shipment.

NOTE 1: Each metal container, before being put into this service, must be passivated by the following or an equally efficient method: By filling drum to 90 per cent of capacity with hydrofluoric acid of 58 per cent strength and allowing drum to stand 48 hours at a temperature of 80°F., and then 7 hours at 140°F., the internal pressure maintained at atmospheric pressure by means of a ventilated bung.

(2) Containers not exceeding 46 gallons capacity each are authorized for carload, and less-than-carload shipment. Containers exceeding 46 gallons capacity each are authorized for carload shipments only but they must be loaded by consignor and unloaded by consignee.

(3) For less-than-carload shipments, containers must be of metal at least as heavy as 14 gauge United States standard for not over 16½ gallons capacity each or 12 gauge for not over 46 gallons capacity each. Each container must be subjected to at least one of the following tests before shipment: By interior pressure of at least 15 pounds per square inch before filling or by holding for inspection for at least 24 hours after filling. In either case, each container must be vented prior to shipment.

§ 73.292 Hexamethylene diamine solution. (a) Hexamethylene diamine solution must be packed in specification containers as follows:

(1) In containers prescribed in § 73. 249.

§ 73.293 Iodine monochloride. (a) Iodine monochloride must be packed in specification containers as follows:

(1) Spec. 15A, 15B, or 19B. Wooden boxes with inside containers not over 1 quart capacity each; or with stone or earthenware jugs not over 1 gallon capacity each.

(b) Outage (vacant space above liquid) for inside containers must be not less than 15 per cent.

(c) Inside containers must be securely closed by hermetical sealing or by glass or stone stoppers ground to fit and securely fastened or by screw caps fitted with gaskets of suitable material resistant to the contents.

(d) Inside containers must be securely cushioned on all sides with incombustible cushioning material which will not produce heat when in contact with iodine monochloride.

§ 73.294 Chloroacetic acid, liquid. (a) Chloroacetic acid, liquid, must be packed in specification containers as follows:

(1) In containers prescribed in § 73.245(a)(1), (2), (3), (6), or (7).

(2) Spec. 103ANW, 103AW, 111A60W2, or 111A100F2. Tank cars. Spec. 103AW, 111A60W2, or 111A100F2 tank cars must be nickel-clad at least 20 percent.

(b) chloroacetic acid, anhydrous, when shipped as a liquid must be shipped in spec 103ANW fabricated of 99 percent pure nickel or in spec. 103AW or 111A60W2, nickel-clad at least 20 percent or be provided with a suitable corrosive resistant coating or lining.

§ 73.295 Benzyl chloride. (a) Benzyl chloride must be packed in specification containers as follows:

(1) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes with glass or earthenware inside containers not over 1 gallon each, except that inside containers up to 3 gallons each are authorized when only one is packed in an outside container.

(2) Spec. 11A or 11B. Wooden barrels or kegs, with glass or earthenware inside containers not over 2 gallons each.

(3) Spec. 1A, or 1D. Glass carboys in boxes, kegs or plywood drums.

(4) Spec. 1X. Boxed carboys, single-trip for export only, are authorized to be transported to ship side by rail freight in carload lots only.

(5) Spec. 5A or 17C (single-trip). Metal barrels or drums with openings not exceeding 2.3 inches in diameter. Authorized for stabilized benzyl chloride only.

(6) Spec. 5K. Nickel drums. When shipped in unstabilized condition, the lading must be anhydrous and must be free from impurities such as iron.

(8) Spec. 60. Portable tanks. Benzyl chloride must be stabilized when loaded in unlined tanks.

(11) Spec. 103A[1], 103A-W, 111A100-F-2, or 111A60W2 tank cars which may be 10 per cent nickel clad. Authorized for stabilized benzyl chloride only.

(12) Spec. 103A-N-W. Tank cars. When shipped in unstabilized condition, the lading must be anhydrous and must be free from impurities such as iron. All cast metal parts of the tank in contact with the lading must have a minimum nickel content of approximately 96.7 per cent.

§ 73.296 Di iso octyl acid phosphate. (a) Di iso octyl acid

[1] Use of existing tank cars authorized, but new construction not authorized.

phosphate must be packed in specification containers as follows:

(1) Spec. 17E. Metal drums (single-trip) with openings not exceeding 2.3 inches in diameter.

(3) Spec. 103AW, 103CW, 103EW, 111A60W2,[1] 111A60W7, or 111A100F2. Tank cars.

§ 73.297 Titanium sulphate solution containing not more than 45 per cent sulphuric acid. (a) Titanium sulphate solution containing not more than 45 per cent sulphuric acid must be packed in specification containers as follows:

(2) Spec. 103B[1], 103BW, or 111A60W5. Tank cars.

(3) Spec. 15A, 15B, 15C, 16A, or 19A. Wooden boxes with inside glass or earthenware containers not over 1 gallon capacity each.

(4) Spec. 6D. Cylindrical steel overpack with inside spec. 2S polyethylene container not over 25 gallons capacity. Overpack of over 12 gallons must be constructed of at least 18-gauge steel throughout.

(5) Spec. 21P. Fibre drum overpack with inside spec. 2U polyethylene container not over 12 gallon capacity or specification 2SL polyethylene container not over 46 gallon capacity. Authorized only for solutions containing not over 20 percent sulphuric acid.

§ 73.298 Memtetrahydro phthalic anhydride. (a) Memtetrahydro phthalic anhydride must be packed in specification containers as follows:

(1) Spec. 15A, 15B, 15C, 16A, or 19A. Wooden boxes with inside glass containers not over 1-gallon capacity each.

(2) Spec. 12A. Fibreboard boxes with inside glass bottles not over 1-gallon capacity each. Not more than 4 inside glass bottles exceeding 5 pints capacity each shall be packed in the outside container. Shipper must have established that the completed package meets test requirements prescribed by para. 10 of Spec. 12A.

(3) Spec. 17E. Metal drums (single-trip) with openings not exceeding 2.3 inches in diameter.

(4) Spec. 37P. Steel drums with polyethylene liner (non-reusable container). Authorized only for materials that will not react with polyethylene and result in container failure.

§ 73.299 Etching acid liquid, n.o.s. (a) Etching acid liquid shall be a mixture of nitric acid, hydrofluoiric acid, having nitric acid in concentrations of not more than 60 per cent by weight, hydrofluoric acid in concentrations of not less than 4 per cent by weight and water not less than 24 per cent by weight and may contain acetic acid. These mixtures must be packed in specification containers as follows:

(1) Spec. 12A. Fibreboard boxes with Spec. 2E inside polyethylene bottles having a minimum wall thickness of 0.030 inch and screwcap closures. Net weight per bottle may not be over 10 pounds each. The net weight per package may not be more than 40 pounds.

(2) Spec. 6D or 37M. Cylindrical steel overpack with inside spec. 2S or 2SL polyethylene container not over 46 gallon capacity. Spec. 37M overpack of over 25 gallon capacity must be constructed of at least 20 gauge steel throughout.

§ 73.299a Tris-(1-aziridinyl) phosphine oxide. (a) Tris-(1-aziridinyl) phosphine oxide must be packed in specification containers as follows:

(1) In containers as prescribed in § 73.245, not over 5 gallons capacity each.

SUBPART F — COMPRESSED AND REFRIGERATED GASES

§ 73.301 General requirements for shipment of compressed gases in cylinders.[2] (a) Gases capable of combining chemically. A cylinder charged with compressed gas shall not contain gases or materials that are capable of combining chemically with each other or with the cylinder material so as to endanger its serviceability. See § 73.34(e)(16) regarding the requalification of a cylinder that previously contained a corrosive liquid.

(b) Ownership of container. A container charged with a compressed gas must not be shipped unless it was charged by or with the consent of the owner of the container.

(c) Retest of container. A container for which prescribed periodic retest has become due must not be charged and shipped until such retest has been properly made.

(d) Manifolding containers in transportation. No means of interconnecting such as manifolding of individual containers may be employed for the transportation of compressed gases, except as hereinafter authorized. Containers so manifolded shall be supported and held together as a unit by structurally adequate means. Safety relief devices on manifolded horizontal containers charged with flammable compressed gas shall be arranged to discharge upward and unobstructed to the open air in such a manner as to prevent any impingement of escaping gas upon the containers.

(1) Manifolding is authorized for containers of the following gases: Argon, Air, Helium, Nitrogen, Oxygen, Carbon dioxide, Nitrous oxide, provided that each such container is individually equipped with approved safety relief devices as required by § 73.34(d) or § 73.315(i).

(2) Manifolding is authorized for cylinders of the following non-liquefied gases: Boron trifluoride, carbon monoxide, ethylene, hydrogen, hydrocarbon gases, and methane, provided individual cylinders are equipped with approved safety relief devices as required by § 73.34(d) or § 73.315(i): And provided further, that each cylinder is equipped with individual shutoff valve, or valves, that must be tightly closed while in transit. Manifold branch lines to these and individual shutoff valves must be sufficiently flexible to prevent injury to the valves which otherwise might result from the use of rigid branch lines. A temperature measuring device may be inserted in one cylinder of a manifold installation in place of the shutoff valve.

(3) Manifolding is authorized for containers of the following gases: Ethane, ethylene, liquefied hydrocarbon gas, hydrogen chloride (anhydrous), liquefied petroleum gas and propylene provided each container is equipped with approved safety relief devices as required by § 73.34(d) or § 73.315(i): And provided further, that each container is equipped with an individual shutoff valve, or valves, that must be tightly closed while in transit. Each container must be separately charged and means must be provided to insure that no interchange of container contents can occur during transportation. Manifolded branch lines to these individual shutoff valves must be sufficiently flexible to prevent injury to the valves which otherwise might result from the use of rigid branch lines.

(4) Manifolding is authorized for containers of acetylene, provided that each container is individually equipped with approved

[1] Use of existing tank cars authorized, but new construction not authorized.

[2] Requirements covering cylinders are also applicable to spherical pressure vessels.

safety relief devices as required by § 73.34(d), and further provided that each container is equipped with an individual shut-off valve, or valves, which shall be tightly closed while in transit. Manifold branch lines to those individual shut-off valves shall be sufficiently flexible to prevent injury to the valves which otherwise might result from the use of rigid branch lines. All manifolded containers shall be transported in a vertical position. For the checking of tare weights or for replacement of solvent the container shall be removed from the manifold. This requirement is not intended to prohibit the charging of the acetylene cylinders while manifolded.

(5) (Cancelled).

(e) Container pressure. The pressure in the container at 70°F. must not exceed the service pressure for which the container is marked or designated, except as provided in § 73.302(c).

NOTE 1: In certain cases with liquefied gases the pressure at 70°F. must be lower than the marked service pressure to avoid having a greater pressure at a temperature of 130°F. than is permitted.

(1) For authorized containers not marked with a service pressure, the service pressure is designated as follows:

Specification marking	Service pressure — psig.
ICC-3[1]	1800
CTC-3E	1800
CTC-4	300
CTC-8	250
CTC-9[1]	200
ICC-25[1]	300
ICC-33[1]	480
ICC-38[1]	250
CTC-40[1]	200
CTC-41[1]	240

(2) For containers made prior to the effective date of specifications, the service pressure is designated as the same as for the same type of container made in accordance with current specifications.

(f) Container pressure at 130°F. The pressure in the container at 130°F. shall not exceed 5/4 times the service pressure, except:

(1) Containers charged with acetylene, liquefied nitrous oxide and liquefied carbon dioxide.

(2) When a cylinder is charged in accordance with § 73.302(c), the pressure in the cylinder at 130°F. must not exceed 5/4 times the filing pressure authorized therein.

(g) Container valve protection. Containers charged with flammable, corrosive, or noxious gases, must have their valves protected by one of the following methods.

(1) By equipping the containers with securely attached metal caps of sufficient strength to protect the valves from injury during transit.

(2) By boxing or crating the containers so as to give proper protection to the valves.

(3) By so constructing the containers that the valve is recessed into the container or otherwise protected so that it will not be subjected to a blow when the container is dropped on a flat surface.

(4) By loading the containers compactly in an upright position and securely bracing in cars or motor vehicles, when loaded by the consignor and to be unloaded by the consignee.

(5) By equipping with valves strong enough to avoid injury during transit for containers containing nonliquefied gas under pressure not exceeding 300 psi. at 70°F.

(h) Compressed gas containers. Compressed gases must be in metal containers built in accordance with the specifications, shown below, in effect at the time of manufacture, and marked as required by the specification and the regulation for retesting if applicable;

Containers			
2P	3C	4BW	8
2Q	3D	4B240ET	8AL
3[1]	3E	4C	9[1]
3A	3HT	4D	25[1]
3A480X	4	4DA	26[1]
3AA	4A	4DS	33[1]
3AAX	4AA	4E	38[1]
3AL	4B	4L	39
3AX	4B240FLW	5	40[1]
3B	4B240X	5F	41[1]
3BN	4BA		

(i) Foreign compressed gas containers.

(1) A charged container manufactured outside Canada shall not be transported by rail unless

(i) it has been manufactured in accordance with the applicable specification,

(ii) it has been tested in accordance with that specification by an inspector approved by the Commission at a location approved by it, and

(iii) a report thereon satisfactory to the Commission has been rendered.

(j) Export shipments of foreign cylinders charged in Canada. (see Note 1 and § 73.8).

A cylinder manufactured in a foreign country in compliance with that country's statutory requirements and authorized thereby for charging with a compressed gas may be charged with that gas in Canada and transported from the charging plant to the port of exit if it complies with the requirements prescribed hereunder:

(1) A copy of the cylinder drawing or specification shall be submitted to the Director of Operation of the Commission for his approval. This information shall be accompanied by a certificate or other evidence that the cylinder will be equipped, retested and filled as prescribed herein.

(2) The cylinder shall be equipped with the appropriate safety relief device as prescribed by § 73.34(d) of these regulations.

(3) Unless the cylinder has been tested hydrostatically at a pressure not less than the pressure prescribed for the equivalent C.T.C. specification cylinder in the same service, it shall be retested at the higher pressure. In addition the cylinder shall receive periodic retests and reinspections as prescribed by § 73.34(e) of these regulations. A record of the identity of the cylinder, the retest dates and the results of the retest shall be maintained by the shipper and be available for examination upon request.

NOTE 1: The purpose of paragraph (j) of § 73.301 is to authorize for export service only, the use of cylinders of foreign manufacture which from the safety point of view are considered by the Director of Operation to be equivalent to the prescribed C.T.C. cylinders, but which may not comply with every one of the specification requirements. Such cylinders shall not be used in domestic service and except as provided in § 73.301(j) no other deviations from the prescribed requirements are intended.

(4) The filling density and service pressure used in charging the cylinder shall not exceed the maximum values prescribed in these regulations for the gas involved.

(5) Bills of lading or other shipping papers accompanying the filled cylinder shall bear the notation, "This export shipment complies with the requirements of § 73.301(j) of the Commis-

[1] Use of existing cylinders authorized, but new construction not authorized.

sion's Regulations for the Transportation of Dangerous Commodities by Rail".

(k) Outside packagings. Spec. 2P, 2Q, 3E, 3HT, 4D, 4DA, 4DS, 9, 39, 40, and 41 must be shipped in strong outside packagings.

(1) Outside packagings must provide protection for the complete cylinder and against accidental functioning of and damage to valves under conditions normally incident to transportation.

§ 73.302 Charging of cylinders with nonliquefied compressed gases. (a) Detailed requirements. Nonliquefied compressed gases (except gas in solution or poisonous gas) for which charging requirements are not definitely prescribed in § 73.304(a)(2) must be shipped, subject to § 73.301, and § 73.305 in specification containers as follows:

(1) Spec. 3[1], 3A, 3AA, 3B, 3C, 3D, 3E, 4, 4A, 4B, 4BA, 4BW, 4C, 25[1], 26[1], 33, or 38[1]. (See §§ 73.34 and 73.301(e).)

(2) Spec. 3HT cylinders for aircraft use only having a maximum service life of 24 years. Authorized only for nonflammable gases. Cylinders must be equipped with safety relief devices only of the frangible disc type which meet the requirements of § 73.34(d). Each frangible disc must have a rated bursting pressure which does not exceed 90 per cent of the minimum required test pressure of the cylinder. Discs with fusible metal backing are not permitted. Spec. 3HT cylinders may be shipped only when packed in strong outside packagings.

(3) Spec. 3AX or 3AAX are authorized only for the following nonliquefied gases:

Air, argon, boron trifluoride, carbon monoxide, ethane, ethylene, helium, hydrogen, methane, neon, nitrogen, or oxygen. As used in this paragraph methane is a nonliquefied gas which has a minimum purity of 98.0 per cent methane and which is commercially free of corroding components.

(4) Spec. 39. For flammable gases, internal volume must not exceed 75 cubic inches.

(5) Spec. 3AL cylinders are authorized only for the following nonliquefied gases: air, argon, carbon monoxide, diborane, ethylene, helium, mercury free hydrogen, krypton, methane, nitrogen, neon, oxygen and xenon. When used in oxygen service, aluminum cylinders must conform to the following conditions:

(i) Cylinder must be equipped with brass or stainless steel valve;

(ii) Cylinder must have only straight threads in the opening;

(iii) Each cylinder must be cleaned in compliance with Federal Specification RR-C-901b, dated August 1, 1967, paragraphs 3.7.2, and 3.8.2. Cleaning agents equivalent to those specified in RR-C-901b may be used but must not be capable of reacting with oxygen. One cylinder selected at random from a group of 200 or less, cleaned at the same time, must be tested for oil contamination in accordance with Specification RR-C-901b, paragraph 4.4.2.3, and meet the standard of cleanliness specified; and

(iv) Cylinder must have a marked service pressure not exceeding 3000 psi.

(b) Filling limits. (See § 73.301(e).)

(c) Special filling limits for specs. 3A, 3AA, 3AX and 3AAX cylinders. Specs. 3A, 3AA, 3AX and 3AAX cylinders may be charged with compressed gases, other than liquefied, dissolved, poisonous, or flammable gases to a pressure 10 per cent in excess of their marked service pressure, provided:

(1) That such cylinders are equipped with frangible disc safety relief devices (without fusible metal backing) having a bursting pressure not exceeding the minimum prescribed test pressure.

(2) That the elastic expansion shall have been determined at the time of the last test or retest by the water jacket method.

(3) That either the average wall stress or the maximum wall stress shall not exceed the wall stress limitation shown in the following table: (See Notes 1 and 2).)

Type of steel	Average wall stress limitation	Maximum wall stress limitation
Plain carbon steels over 0.35 carbon and medium manganese steels	53,000	58,000
Steels of analysis and heat-treatment specified in spec 3AA	67,000	73,000
Plain carbon steels less than 0.35 carbon made prior to 1920	45,000	48,000

NOTE 1: The average wall stress shall be computed from the elastic expansion data using the following formula:

$$S = \frac{1.7EE}{KV} - 0.4P$$

where

S = wall stress, pounds per square inch;
EE = elastic expansion (total less permanent) in cubic centimeters;
K = factor x 10^{-7}, experimentally determined for the particular type of cylinder being tested;
V = internal volume in cubic centimeter (1 cubic inch = 16.387 cubic centimeters);
P = test pressure, pounds per square inch.

Formula derived from formula of Note 2 and the following:

$$EE = PKV \times \frac{D^2}{D^2 - d^2}$$

NOTE 2: The maximum wall stress shall be computed from the formula:

$$S = P\,\frac{(1.3D^2 + 0.4d^2)}{D^2 - d^2}$$

where

S = wall stress, pounds per square inch;
P = test pressure, pounds per square inch;
D = outside diameter, inches;
d = D − 2t, where t = minimum wall thickness determined by a suitable method.

(4) That an external and internal visual examination made at the time of test or retest shows the cylinder to be free from excessive corrosion, pitting, or dangerous defects.

(5) That a plus sign (+) be added following the test date marking on the cylinder to indicate compliance with subparagraphs (c)(2), (3) and (4) of this section.

(d) Fluorine. Fluorine must be shipped in Specification 3A1000, 3AA1000, or 3BN400 cylinders without safety relief device and equipped with valve protection cap. Such containers must not be charged to over 400 psig. at 70°F. and must not contain over 6 pounds of gas.

(e) Verification of container pressure.

(1) Each day, the pressure in a container representative of that day's compression must be checked by the charging plant after the container has cooled to a settled temperature and a record of this test kept for at least 30 days.

(f) Carbon monoxide. Carbon monoxide must be shipped in spec. 3A, 3AX, 3AA, 3AAX, 3AL, 3, or 3E cylinders hav-

[1] Use of existing cylinders authorized, but new construction not authorized.

ing a minimum service pressure of 1800 psig. The pressure in the cylinder must not exceed 1,000 pounds per square inch gauge at 70°F. except that if the gas is dry and sulphur free then cylinders may be charged up to five-sixths the cylinder service pressure or 2,000 psi. whichever is the lesser.

(g) Diborane and diborane mixtures. Diborane and diborane mixed with compatible compressed gas in spec. 3AA1800 cylinders. The maximum filling density of the diborane shall not exceed 7 percent. Diborane mixed with compatible compressed gas must not have a pressure exceeding the service pressure of the cylinder if complete decomposition of the diborane occurs. Cylinder valves must be protected either by metal caps or by over-packing cylinder in strong wooden boxes.

§ 73.303 Charging of cylinders with compressed gas in solution (acetylene). (a) Cylinder, filler and solvent requirement. Acetylene gas must be shipped in cylinders, spec. 8, 8AL or 8WC. The cylinders shall consist of metal shells filled with a porous material and this material must be charged with a suitable solvent. Before entering service, cylinders containing the porous material and solvent, and representative samples of cylinders charged with acetylene, shall be tested with satisfactory results in accordance with CGA Pamphlet C-12.

(1) The specific gravity of acetone solvent in acetylene cylinders must be 0.796 or over at 15.5°C., (59.9°F).

(2) The amount of solvent added in the refilling operation must not cause the tare weight of the cylinder to exceed its marked tare weight. The tare weight includes the weight of the cylinder shell, porous filling, valve, safety relief devices and solvent, but without removable cap.

(b) Filling limits. The pressure in cylinders containing acetylene gas must not exceed 250 psi. at 70°F., and in case the cylinders are marked for a lower allowable charging pressure, at 70°F., then that pressure must not be exceeded.

(c) Data requirements on filler and solvent. Cylinders containing acetylene gas must not be shipped unless they were charged by or with the consent of the owner, and by a person, firm, or company having possession of complete information as to the nature of the porous filling, the kind and quantity of solvent in the cylinders, and the meaning of such markings on the cylinders as are prescribed by the commission's regulations and specifications applying to containers for the transportation of acetylene gas.

(d) Verification of container pressure.

(1) Each day, the pressure in a container representative of that day's compression must be checked by the charging plant after the container has cooled to a settled temperature and a record of this test kept for at least 30 days.

§73.304 Charging of cylinders with liquefied compressed gas. (a) Detailed charging requirements. Liquefied gases shall be charged in accordance with the specific provisions of paragraph (a)(2) or (e) of this section. Where charging requirements are not specifically prescribed, liquefied gases, except gas in solution or poisonous gas, must be shipped, subject to the applicable paragraphs under General Requirements for shipment ((see § 73.301), the charging requirements of this section for liquefied compressed gas, or the charging requirements for mixtures) (see § 73.305), in containers manufactured under specifications, as follows:

(1) Specifications 3[1], 3A, 3AA, 3B, 3BN, 3D, 3E, 4, 4A, 4B, 4BA, 4B-ET, 4BW, 4E, 9[1], 25[1], 26[1], 38[1], 39, 40[1], or 41[1] except that no Spec. 9, 39, 40, or 41 packaging may be charged and shipped with a mixture containing a pyrophoric liquid, carbon bisulphide (disulphide), ethyl chloride, ethylene oxide, nickel carbonyl, spirits of nitroglycerin, or poisonous material unless specifically authorized.

(i) For flammable gases, the internal volume of a specification 39 cylinder must not exceed 75 cubic inches.

(2) The following restrictions must be complied with for the gases named:

Kind of gas	Maximum permitted filling density (See Note 1)	Containers marked as shown in this column or of the same type with higher service pressure must be used except as provided in § 73.34(a), (b), § 73.301(j) (see notes following table).
	Per cent	
Anhydrous ammonia	54	CTC-4; CTC-3A480; CTC-3AA-480; CTC-3A480X; CTC-4A480; ICC-3; CTC-4AA480; CTC-3E-1800; CTC-3AL480.
Argon, pressurized liquid	115	CTC-4L200.
Carbon dioxide, liquefied (see Notes 3, 4, 7 and 8)	68	CTC-3A1800; CTC-3AA1800; ICC-3; CTC-3E1800; CTC-3HT2000; CTC-39; CTC-3AL1800.
Carbon dioxide-nitrous oxide mixture (see Notes 7 and 8)	68	CTC-3A1800; CTC-3AA1800; ICC-3; CTC-3E1800; CTC-3HT2000; CTC-39; CTC-3AL1800.
Chlorine (see Note 2)	125	CTC-3A480; CTC-3AA480; ICC-25; ICC-3; CTC-3BN480; CTC-3E1800.
Cyclopropane (see Notes 8 and 9)	55	CTC-3A225; CTC-3A480X; CTC-3AA225; CTC-3B225; CTC-4A225; CTC-4AA480; CTC-4B225; CTC-4BA225; CTC-4BW225; CTC-4B240ET; ICC-3; CTC-3E1800; CTC-39; CTC-3AL225.
Dichlorodifluoromethane (see Note 8)	119	CTC-3A225; CTC-3AA225; CTC-3B225; CTC-4A225; CTC-4B225; CTC-4BA225; CTC-4BW225; CTC-4B240ET; CTC-4E225; CTC-9; CTC-39; CTC-41; CTC-3E1800.
Dichlorodifluoromethane and difluoroethane mixture (constant boiling mixture) (see Note 8)	Not liquid full at 130°F.	CTC-3A240; CTC-3AA240; CTC-3B240; CTC-3E1800; CTC-4A240; CTC-4B240; CTC-4BA240; CTC-4BW240; CTC-9; CTC-39.
Difluoroethane	79	CTC-3A150; CTC-3AA150; CTC-3B150; CTC-4B150; CTC-4BA225; CTC-3E-1800.
Difluoromonochloroethane (see Note 8)	100	CTC-3A150; CTC-3AA150; CTC-3B150; CTC-4B150; CTC-4BA225; CTC-4BW225; CTC-3E1800; CTC-39.
Dimethylamine, anhydrous	59	CTC-3A150; CTC-3AA150; CTC-3B150; CTC-4B150; CTC-4BA225; CTC-3E1800.
Ethane (see Notes 8 and 9)	35.8	CTC-3A1800; CTC-3AA1800; ICC-3; CTC-3E1800; CTC-39.
Ethane (see Notes 8 and 9)	36.8	CTC-3A2000; CTC-3AA2000; CTC-39.

[1] Use of existing cylinders authorized, but new construction not authorized.

Kind of gas	Maximum permitted filling density (See Note 1)	Containers marked as shown in this column or of the same type with higher service pressure must be used except as provided in § 73.34(a), (b), § 73.301(j) (see notes following table).
	Per cent	
Ethylene (see Notes 8 and 9)	31.0	CTC-3A1800; CTC-3AA1800; ICC-3; CTC-3E1800; CTC-39.
Ethylene (see Notes 8 and 9)	32.5	CTC-3A2000; CTC-3AA2000; CTC-39.
Ethylene (see Notes 8 and 9)	35.5	CTC-3A2400; CTC-3AA2400; CTC-39.
Hydrogen chloride	65	CTC-3A1800; CTC-3AA1800; CTC-3AX1800; CTC-3AAX1800; ICC-3; CTC-3E1800.
Hydrogen sulphide	62.5	CTC-3A480; CTC-3AA480; CTC-3B480; CTC-4A480; CTC-4B480; CTC-4BA480; ICC-26-480; CTC-3E1800.
Insecticide, liquefied gas (see Note 8)	Not liquid full at 130°F.	CTC-3A300; CTC-3AA300; CTC-3B300; CTC-4B300; CTC-4BA300; CTC-9; CTC-40; CTC-41; CTC-3E1800.
Liquified nonflammable gases, liquids other than those classified as flammable, corrosive, or poisonous, and mixtures or solutions thereof, charged with nitrogen, carbon dioxide, or air (see Notes 7 and 8)	Not liquid full at 130°F.	CTC-3A300; CTC-3AA300; CTC-4B300; CTC-4BA300; CTC-4BW300; CTC-4D300; CTC-4DA500; CTC-4DS500; CTC-3E1800; CTC-39.
Methylacetylene-propadiene, stabilized (see Note 8)	Not liquid full at 130°F.	CTC-4B240, without brazed seams; CTC-4BA240, without brazed seams; CTC-3A240; CTC-3AA240; CTC-3B240; CTC-3E1800; CTC-4BW420; CTC-4B240ET; CTC-4; CTC-41.
Methyl chloride	84	CTC-3A225; CTC-3AA225; CTC-3B225; CTC-4A225; CTC-4B225; CTC-4BA225; ICC-3; CTC-4; ICC-25; ICC-26-300; ICC-38; CTC-3E1800; CTC-4B240ET. Cylinders complying with CTC-3A150; CTC-3B150; CTC-4A150, and CTC-4B150 manufactured prior to December 7, 1936 are also authorized.
Methyl mercaptan	80	CTC-3A240; CTC-3AA240; CTC-3B240; CTC-4B240; CTC-4B240ET; CTC-3E1800; CTC-4BA240.
Monochlorodifluoromethane (see Note 8)	105	CTC-3A240; CTC-3AA240; CTC-3B240; CTC-4B240; CTC-4BA240; CTC-4BW240; CTC-4B240ET; CTC-4E240; CTC-39; CTC-41; CTC-3E1800.
Monochloropentafluoroethane (see Note 8)	110	CTC-3A225; CTC-3AA225; CTC-3B225; CTC-4A225; CTC-4B225; CTC-4BA225; CTC-4BW225; CTC-3E1800; CTC-39.
Monochlorotrifluoromethane (see Note 8)	100	CTC-3A1800; CTC-3AA1800; ICC-3; CTC-3E1800; CTC-39.
Monomethylamine, anhydrous	60	CTC-3A150; CTC-3AA150; CTC-3B150; CTC-4B150; CTC-4BA225; CTC-4BW225; CTC-3E1800.
Nitrogen, pressurized liquid	68	CTC-4L200.
Nitrosyl chloride	110	CTC-3BN400 only.
Nitrous oxide (see Notes 7 and 8)	68	CTC-3A1800; CTC-3AA1800; ICC-3; CTC-3E1800; CTC-3HT2000; CTC-39; CTC-3AL1800.
Oxygen pressurized liquid	96	CTC-4L200.
Sulphur dioxide (see Note 8)	125	CTC-3A225; CTC-3AA225; CTC-3B225; CTC-4A225; CTC-4B225; CTC-4BA225; CTC-4BW225, CTC-4B240ET; ICC-3; CTC-4; ICC-25; ICC-26-150; ICC-38; CTC-39; CTC-3E-1800; CTC-3AL225.
Sulphur hexafluoride	110	CTC-3A1000; CTC-3AA1000; ICC-3; CTC-3E1800.
Sulphuryl fluoride	106	CTC-3A480; CTC-3AA480; CTC-4B480; CTC-4BA480; CTC-4BW480.
Tetrafluoroethylene, inhibited	90	CTC-3A1200; CTC-3AA1200; CTC-3E1800.
Trifluorochloroethylene	115	CTC-3A300; CTC-3AA300; CTC-3B300; CTC-4A300; CTC-4B300; CTC-4BA300; CTC-4BW300; CTC-4BW225; CTC-3E1800.
Trimethylamine, anhydrous	57	CTC-3A150; CTC-3AA150; CTC-3B150; CTC-4B150; CTC-4BA225; CTC-4BW225; CTC-3E1800.
Vinyl chloride (see Note 5)	84	CTC-4B150, without brazed seams; CTC-4BA225; CTC-4BW225, without brazed seams; CTC-3A150; CTC-3AA150; ICC-25; CTC-3E1800; CTC-3AL150.
Vinyl fluoride, inhibited	62	CTC-3A1800; CTC-3AA1800; CTC-3E1800.
Vinyl methyl ether, inhibited (see Note 5)	68	CTC-4B150, without brazed seams; CTC-4BA225, without brazed seams; CTC-3A150; CTC-3AA150; CTC-3B150; ICC-25; CTC-3E1800.

NOTE 1: The "filling density" is hereby defined as the per cent ratio of the weight of gas in a container to the weight of water that the container will hold measured at 60°F.

NOTE 2: Cylinders purchased after October 1, 1944, for the transportation of chlorine must contain no aperture other than that provided in the neck of the cylinder for attachment of a valve equipped with an approved safety relief device. Cylinders purchased after November 1, 1935, and charged with chlorine must not contain over 150 pounds of gas.

NOTE 4: Special carbon dioxide mining devices containing a heating element and charged with not over six pounds of carbon dioxide may be filled to a density of not over 85 per cent, provided the cylinder is made of steel with a calculated bursting pressure in excess of 39,000 psi, be fitted with a frangible disc that will operate at not over 57 per cent of that pressure and be able to withstand a drop of 10 feet when striking cross-wise on a steel rail while under a pressure of at least 3,000 psi. Such devices must be shipped in strong boxes or must be wrapped in heavy burlap and bound by 12-gauge wire with the wire completely covered by friction tape. Wrapping must be applied so as not to interfere with the functioning of the frangible disc safety relief device. Shipments must be described as "liquefied carbon dioxide gas (mining device)" and marked, labelled, and certified as prescribed for liquefied carbon dioxide.

NOTE 5: All parts of valve and safety relief devices in contact with contents of cylinders must be of a metal or other material, suitably treated if necessary, which will not cause formation of any acetylides.

NOTE 6: (Cancelled).

NOTE 7: Spec. 3HT cylinders for aircraft use only having a maximum service life of 24 years. Authorized only for nonflammable gases. Cylinders must be equipped with safety relief devices only of the frangible disc type which meet the requirements of § 73.34(d). Each frangible disc must have a rated bursting pressure which does not exceed 90 per cent of the minimum required test pressure of the cylinder. Discs with fusible metal backing are not permitted. Spec. 3HT cylinders may be shipped only when packed in strong outside packagings

NOTE 8: See § 73.301(k).

NOTE 9: When used for shipment of flammable gases, the internal volume of a specification 39 cylinder must not exceed 75 cubic inches.

(3) Spec. 3AL cylinders are authorized also for the following liquefied gases: cyclobutane, hydrogen selenide, propylene, silane, carbonyl sulfide, bromochlorodifluoromethane, vinyl bromide, and dimethyl ether.

(4) Spec. 3AL cylinders are authorized for nitrous oxide service if they conform to the following conditions:

(i) Cylinder must be equipped with brass or stainless steel valve; and

(ii) Each cylinder must be cleaned in compliance with Federal Specification RR-C-901b paragraphs 3.7.2 and 3.8.2. Cleaning agents equivalent to those specified in RR-C-901b may be used but must not be capable of reacting with oxygen. One cylinder selected at random from a group of 200 or less cleaned at the same time must be tested for oil contamination in accordance with Specification RR-C-901b paragraph 4.4.2.3 and meet the standard of cleanliness specified.

(b) Filling limits. (See § 73.301(f).)

(1) For a liquefied compressed gas the liquid portion of the content at 130°F. must not completely fill the container.

NOTE 1: Maximum filling densities are permitted by paragraph (a)(2) of this section for certain liquefied compressed gases, having critical temperatures below 130°F. that result in the container being liquid full below the critical temperature, but because of compressibility of the liquids, the maximum pressure requirements of § 73.301(f) are met up to and including 130°F.

NOTE 2: Cylinders containing vinyl fluoride, inhibited, may be liquid full at 130°F. provided the pressure at the critical temperature does not exceed one and one-fourth times the service pressure.

(2) The pressure in CTC-4L cylinders must be limited by a pressure controlling valve so sized and set as to limit the pressure to one and one-fourth times the marked service pressure. The liquid portion of the gas must not completely fill the cylinder. For CTC-4L cylinders insulated by a vacuum the pressure control valve must be set at least 15 psi. lower than one and one-fourth times the marked service pressure. The other paragraphs of this section do not apply to CTC-4L cylinders.

(c) Verification of content in cylinder.

(1) Liquefied gases must be charged by weight, by volume measurement of liquid, or when lower in pressure than required for liquefaction a pressure-temperature chart may be used in charging to insure that the service pressure at 70°F. times 5/4 will not be exceeded at 130°F.

(2) Except as noted in paragraph (d)(4) of this section the amount of liquefied gas charged into a container must be determined by weight, or if charged at a pressure lower than the liquefaction point, by pressure shown on a chart for the specific gas. Weight must be checked, after disconnecting from the charging line, by the use of proper scales.

(d) Requirements for liquefied petroleum gas.

(1) Filling density limited as follows:

Minimum specific gravity of the liquid material at 60°F.	Maximum filling density in per cent of the water-weight capacity of the container	Minimum specific gravity of the liquid material at 60°F.	Maximum filling density in per cent of the water-weight capacity of the container
0.271-0.289	26	0.504-0.510	42
0.290-0.306	27	0.511-0.519	43
0.307-0.322	28	0.520-0.527	44
0.323-0.338	29	0.528-0.536	45
0.339-0.354	30	0.537-0.544	46
0.355-0.371	31	0.545-0.552	47
0.372-0.398	32	0.553-0.560	48
0.399-0.425	33	0.561-0.568	49
0.426-0.440	34	0.569-0.576	50
0.441-0.452	35	0.577-0.584	51
0.453-0.462	36	0.585-0.592	52
0.463-0.472	37	0.593-0.600	53
0.473-0.480	38	0.601-0.608	54
0.481-0.488	39	0.609-0.617	55
0.489-0.495	40	0.618-0.626	56
0.496-0.503	41	0.627-0.634	57

(2) Subject to § 73.301(f), any filling density percentage prescribed in this section is authorized to be increased by 2 for liquefied petroleum gas in spec. 26 or 3 cylinders or in spec. 3A marked for 1,800 psig. or higher, service pressure.

(3)Liquefied petroleum gas must be shipped in specification containers as follows:

(i) Spec. 3[1], 3A, 3AA, 3B, 3E, 3AL, 4A, 4B, 4BA, 4B240ET, 4BW240, 4B240X[1], 4B240FLW, 4E, 4, 9[1], 25[1], 26[1], 38[1], 39, or 40[1]. The internal volume of a specification 39 cylinder must not exceed 75 cubic inches.

NOTE 1: Cylinders marked as complying with DOT spec. 4B240FLW bearing manufacturer's symbol WCO and serial numbers 47A-1 to 47A-59200, inclusive, varying from the specification requirements as to physical properties of steel, are authorized for the transportation of liquefied petroleum gases.

(ii) Additional containers may be used within the limits of quantity and pressure as follows:

Type of container	Maximum Capacity		Maximum charging pressure—psig.
	Cubic inches	Gallons	
CTC-2P	31.83		45 psig at 70°F.and 105 psig at130°F. (see Note 2)
CTC-2P	31.83		27 psig at 70°F.and 84 psig at130°F. (see Note 2)
CTC-3C and CTC-4C	3881	16 + 5% tolerance	145 psig at 130°F.

NOTE 1: (Cancelled).

NOTE 2: Containers must be equipped with safety relief devices which will prevent rupture of the containers and dangerous projection of the closing devices when the containers are exposed to the action of fire.

(4) Verification of content. Containers with a water capacity of 200 pounds or more and for use with a liquefied petroleum gas with a specific gravity at 60°F. of 0.504 or greater may have their content determined by using a fixed length dip tube gaug-

[1] Use of existing cylinders authorized, but new construction not authorized.

ing device. The length of the dip tube shall be such that when a liquefied petroleum gas with a specific volume of 0.03051 cu. ft./lb. at a temperature of 40°F. is charged into the container it just reaches the bottom of the tube. The weight of this liquid shall not exceed 42 per cent of the water capacity of the container which must be stamped thereon. The length of the dip tube, expressed in inches carried out to one decimal place and prefixed with the letters "DT" shall be stamped on the container and on the exterior of removable type dip tube, for the purpose of this requirement the marked length shall be expressed as the distance measured along the axis of a straight tube from the top of the boss through which the tube is inserted to the proper level of the liquid in the container. The length of each dip tube shall be checked when installed by weighing each container after filling except when installed in groups of substantially identical containers in which case one of each 25 containers shall be weighed. The quantity of liquefied gas in each container must be checked by means of the dip tube after disconnecting from the charging line. The outlet from the dip tube shall be not larger than a No. 54 drill size orifice. A container representative of each day's filling at each charging plant shall have its contents checked by weighing after disconnecting from the charging line.

(e) Refrigerant gases. Refrigerant gases which are non-poisonous and nonflammable under this part, must be shipped in cylinders as prescribed in paragraph (a) (1) or (2) of this section, or as follows:

(1) Spec. 2P and 2Q. Inside metal containers packed in a strong wooden or fibreboard box of such design as to protect valves from injury or accidental functioning under conditions incident to transportation. Pressure in the container must not exceed 85 pounds per square inch absolute at 70°F. Each completed metal container filled for shipment must be heated until content reaches a minimum temperature of 130°F. without evidence of leakage, distortion, or other defect. Each outside shipping container must be plainly marked "INSIDE CONTAINERS COMPLY WITH PRESCRIBED SPECIFICATION".

(f) Engine starting fluid. Engine starting fluid containing compressed gas or gases which are flammable under this part must be shipped in cylinders as prescribed in paragraph (a) (1) of this section, or as follows:

(1) Inside nonrefillable metal containers of capacity not exceeding 32 cubic inches. Containers must be packaged in spec. 12B fibreboard boxes equipped with top and bottom pads which will provide three complete thickness of fibreboard on tops and bottoms of boxes, of spec. 15A, 15B, or 15C wooden boxes. Pressure in the container must not exceed 140 psi., absolute, at 130°F. However, if the pressure exceeds 140 psi., absolute at 130°F., a spec. 2P container must be used. In any event, the metal container must be capable of withstanding without bursting a pressure of one and one-half times the pressure of the content at 130°F. The liquid content of the material and gas must not completely fill the container at 130°F. Each completed container filled for shipment must have been heated until content reaches a minimum temperature of 130°F., without evidence of leakage distortion, or other defect. Each outside shipping container must be plainly marked. "INSIDE CONTAINERS COMPLY WITH PRESCRIBED SPECIFICATIONS."

§ 73.305 Charging of cylinders with a mixture of compressed gas and other material. (a) Detailed requirements. A mixture of a compressed gas and any other material must be shipped as a compressed gas if the mixture is a compressed gas as designated in § 73. 300(a) and when not in violation of § 73.301 (a).

(b) Filling limits. (See § 73.301 (e). For mixtures, the liquid portion of the liquefied compressed gas at 130°F. plus any additional liquid or solid must not completely fill the container.

(c)Nonpoisonous and nonflammable mixtures. Mixtures containing compressed gas or gases including insecticides, which mixture are nonpoisonous and nonflammable under this part must be shipped in cylinders as prescribed in § 73.304(a) or as follows:

(1) Spec. 2P. Inside metal containers equipped with safety relief devices of a type approved by the Commission or the Bureau of Explosives and packed in strong wooden or fibre boxes of such design as to protect valves from injury or accidental functioning under conditions incident to transportation. Pressure in the container must not exceed 85 psi. absolute at 70°F. Each completed metal container filled for shipment must be heated until content reaches a minimum temperature of 130°F., without evidence of leakage, distortion or other defect. Each outside shipping container must be plainly marked "INSIDE CONTAINERS COMPLY WITH PRESCRIBED SPECIFICATIONS."

§ 73.306 Exemptions from compliance with regulations for shipping compressed gas. (a) General exemptions. Compressed gases, except poisonous gases and except those for which not exemptions are provided as indicated by the "No exemption" statement in § 72.5 when, in accordance with one of the following subparagraphs are, unless otherwise provided, exempt from specification packaging requirements.

(1) When in containers of not more than 4.2 fluid ounces water capacity (7.22 cubic inches or less).

(2) When in metal containers filled with non-dangerous material to not over 90 per cent capacity at 70°F. then charged with nonflammable, non-liquefied gas; each container must be tested to three times the gas pressure at 70°F., and, when refilled, each container must be retested to 3 times the gas pressure at 70°F. provided one of the following conditions is met:

(i) Container is not over 1 quart capacity charged to not over 170 psig. at 70°F.

(ii) Container is not over 25 gallons capacity charged to not over 75 psig. at 70°F.

(3) When in inside non-refillable metal containers charged with a solution of materials and compressed gas or gases which is non-poisonous, provided all of the following conditions are met:

(i) Capacity must not exceed 50 cubic inches (28.8 fluid ounces). See Note 1.

(ii) Pressure in the container must not exceed 180 psig. at 130°F. If the pressure exceeds 140 psig. at 130°F., but does not exceed 160 psig. at 130°F., a specification 2P inside metal container must be used; if the pressure exceeds 160 psig. at 130°F., a specification 2Q inside metal container must be used. In any event, the metal container must be capable of withstanding without bursting a pressure of one and one-half times the equilibrium pressure of the content at 130°F.

(iii) Liquid content of the material and gas must not completely fill the container at 130°F.

(iv) Cancelled.

(v) Each completed container filled for shipment must have been heated until the pressure in the container is equivalent

to the equilibrium pressure of the content at 130°F. without evidence of leakage, distortion, or other defect.

NOTE 1: Compressed gases contained in non-refillable inside metal containers exceeding 35 cubic inches (19.3 fluid ounces) but not exceeding 50 cubic inches (27.7 fluid ounces) packaged in accordance with subparagraph (a) (3) of this section shall be packaged in outside containers. Each outside shipping container shall also be plainly marked, "INSIDE CONTAINERS COMPLY WITH PRESCRIBED REGULATIONS."

(b) Exemption for foodstuffs, soap, cosmetics, beverages, biologicals, electronic tubes and audible fire alarm systems. Compressed gases, except poisonous gases and except those for which no exemptions are provided as indicated by the "No exemption" statement in § 72.5, when in accordance with one of the following subparagraphs are, unless otherwise provided, exempt from specification packaging requirements.

(1) Carbonated beverages.

(2) Foodstuffs or soaps in non-refillable metal containers not exceeding 50 cubic inch capacity (28.8 fluid ounces) (see Note 1), with soluble or emulsified compressed gas, provided the pressure in the container does not exceed 140 psig. at 130°F. The metal container must be capable of withstanding without bursting a pressure of one and one-half times the equilibrium pressure of the content at 130°F.

NOTE 1: Compressed gases contained in non-refillable inside metal containers exceeding 35 cubic inches (19.3 fluid ounces) but not exceeding 50 cubic inches (27.7 fluid ounces) packaged in accordance with subparagraph (b) (2) of this section shall be packaged in outside containers. Each outside shipping container shall also be plainly marked. "INSIDE CONTAINERS COMPLY WITH PRESCRIBED REGULATIONS."

(3) Cream in refillable metal containers with soluble or emulsified compressed gas. Containers shall be of such design that they will hold pressure without permanent deformation up to 375 psig. and shall be equipped with a device designed so as to release pressure without bursting of the container or dangerous projection of its parts at higher pressures. This exemption applies to shipments offered for transportation by refrigerated cars only.

(4) Inside non-refillable metal containers charged with a solution containing biological products or a medical preparation which will be deteriorated by heat, and compressed gas or gases, which is non-poisonous and nonflammable, and of capacity not to exceed 35 cubic inches (20.2 fluid ounces). Pressure in the container not to exceed 140 psig, at 130°F., and the liquid content of the product and gas must not completely fill the container at 130°F. One completed container out of each lot of 500 or less, filled for shipment, must be heated, until the pressure in the container is equivalent to the equilibrium pressure of the content at 130°F., without evidence of leakage, distortion, or other defect.

(5) Electronic tubes of not more than 30 cubic-inch volume charged with gas to a pressure of not more than 35 psig.

(6) Inside metal containers of a capacity not to exceed 35 cubic inches (20.2 fluid ounces), charged with nonflammable, nonpoisonous liquified compressed gas to be used in conjunction with audible fire alarm systems. Pressure in the container must not exceed 70 psig. at 70°F. The completely assembled container must be capable of withstanding without bursting a pressure of 1,000 psig. The liquid portion of the gas must not completely fill the container at 130°F.

(c) Fire extinguishers. Fire extinguishers charged with limited quantities of a compressed gas to not more than 240 psig at 70°F. are exempted from specification packaging requirements of this part when shipped under the following conditions.

(1) Each fire extinguisher must be shipped in an inside container:

(2) No fire extinguisher may contain flammable liquids, poisonous substances, corrosives, or dangerous goods in class 4.

(3) No fire extinguisher under stored pressure may have an internal volume exceeding 1,100 cubic inches. For fire extinguishers not exceeding 35 cubic inches capacity, the liquid portion of the gas plus any additional liquid or solid must not completely fill the container at 130°F. Fire extinguishers exceeding 35 cubic inches capacity may not contain any liquefied compressed gas;

(4) Each fire extinguisher manufactured on or after January 1, 1976, must be designed and fabricated with a burst pressure of not less than six times its charged pressure at 70°F. when shipped.

(5) Except as provided in subparagraph (c)(6) of this section, each container must be tested before shipment to at least three times the pressure in the container at 70°F, when charged and not less than 120 pounds per square inch, and before refilling and reshipping must be retested at this pressure before each shipment. The container shall show no leakage or damage when subject to this pressure.

(6) When spec. 2P inside metal containers are used for pressures not exceeding 85 psi. absolute, at 70°F. or 115 psi. absolute, at 130°F. the test requirements of paragraph (c)(5) of this section do not apply, but each container must be capable of having the contents heated to 130°F. without evidence of leakage or permanent distortion.

(d) Truck bodies or trailers on flat cars; automobiles, motorcycles, tractors, or other self-propelled vehicles.

(1) Truck bodies or trailers with automatic heating or refrigerating equipment of the gas burning type may be shipped with fuel tanks filled and equipment operating or inoperative, when used for the transportation of other freight and loaded on flat cars as part of a joint rail-highway movement, provided the equipment and fuel supply are of a type approved by the Commission or the Bureau of Explosives. The heating or refrigerating units are exempt from specification packaging requirements in this service and shall be considered as carriers equipment but not as shipments.

(2) Automobiles, motorcycles, tractors, or other self-propelled vehicles, equipped with liquefied petroleum gas or other fuel tanks, provided such tanks are securely closed, are exempt from specification packaging requirements. When offered for transportation by carriers by rail freight, drainage of fuel tanks is not required. When offered for transportation by rail express, fuel tanks must have been emptied and securely closed.

(e) Refrigerating machines and hydraulic accumulators.

(1) Refrigerating machines or components thereof which are to be shipped only once to a point of installation are exempt from specification packaging. Shipments under these exemptions may be made only under the following conditions:

(i) Each pressure vessel may not contain more than 1,000 pounds of Group 1 refrigerant as classified in American National Standard B9.1 or not more than 50 pounds of refrigerant other than Group 1.

(ii) Machines or components having two or more charged vessels may not contain an aggregate of more than 2,000 pounds of Group 1 refrigerant or more than 100 pounds of refrigerant other than Group 1.

(iii) Each pressure vessel must be equipped with a safety de-

vice meeting the requirements of American National Standard B9.1.

(iv) Each pressure vessel must be equipped with a shut-off valve at each opening except openings used for safety devices and no other connection. Such valves must be closed prior to and during transportation.

(v) Pressure vessels must be manufactured, inspected and tested in accordance with American National Standard B9.1, or when over 6 inches internal diameter, in accordance with the ASME Code.

(vi) All parts subject to refrigerant pressure during shipment must be tested in accordance with American National Standard B9.1.

(vii) The liquid portion of the refrigerant, if any, may not completely fill any pressure vessel at 130°F.

(viii) The amount of refrigerant, if liquefied, may not exceed the filling density prescribed in § 73.304.

(2) Hydraulic accumulators. Hydraulic accumulators and component parts thereof containing non-liquefied, non-flammable gas for the purpose of operation when shipped under the following conditions are exempt from specification packaging requirements.

(i) Must be shipped as inside containers.

(ii) The container under store pressure shall have an internal volume not exceeding 1,100 cubic inches.

(iii) The pressure in the container shall not exceed 200 pounds psi at 70°F.

(iv) The content shall be nonflammable.

(v) Each container must be tested before shipment to at least three times the pressure in the container at 70°F. when charged and not less than 120 psi., and before refilling and reshipping must be retested at this pressure before each shipment. The container shall show no leakage or damage when subjected to this pressure.

(f) any package containing a cigarette lighter or other similar device with fuel and equipped with an ignition element may be transported by rail provided the design of the device and its packaging insofar as they affect safety in transportation have been approved by the Director of Operation, R.T.C.

§ 73.307 Exceptions for Compressed Gases. (a) The following commodities are exempt from these regulations:

(1) Carbonated beverages.

(2) Tires when inflated to pressures not greater than their rated inflation pressures.

(3) Balls used for sports, and

(4) Refrigerating machines including dehumidifiers and air conditioners, and components thereof such as precharged tubing containing 15 kg or less of nonflammable liquefied gas.

§ 73.314 Requirements for compressed gases in tank cars.

(b) General requirements.

(1) Tank cars containing compressed gases must not be shipped unless they were loaded by or with the consent of the owner thereof.

(2) Tank cars must not contain gases capable of combining chemically and must not be loaded with any gas which combines chemically with the gas previously loaded therein, until all residue has been removed and interior of tank thoroughly cleaned.

(3) For cars of the 106A and 110A class, the tanks must be placed in position and attached to car structure by the shipper.

(4) Wherever the word "approved" is used in this part of the regulations, it means approval by the Association of American Railroads Committee on Tank Cars as prescribed in § 79.3.

(c) Authorized gases, filling densities, tank cars. Compressed gases transported in tank cars must be shipped as provided in paragraphs (b) to (g) of this section, § 74.560 and the following table:

Kind of gas	Maximum permitted filling density Note 1	Required tank car, see § 73.31 (a)(2) and (3)
	Per cent	
Anhydrous ammonia ...	50	106A500-X, Note 7.
	57	105A300-W. Note 24.
	57	112A400-F, 112A340-W, 114A340-W, Note 15.
	58.8	112A400-F, 112A340W, 114A340-W, Note 15.
Aqua ammonia solution containing anhydrous ammonia	Note 21	105A100W, 105A100-AL-W, 109A100-AL-W, 109A300-W, 111A100-W4, Note 20.
Argon	Note 20	107A.
Butadiene (pressure not exceeding 75 pounds per square inch at 105°F.), inhibited	Notes 18 and 21	106A500X, ICC-105A100[1], 105A100-W, Note 23. 111A100-W-4, Note 4.
Butadiene (pressure not exceeding 255 pounds per square inch at 115°F.), inhibited	Notes 18 and 21	112A340-W, 114A340-W Notes 4 and 20
Butadiene (pressure not exceeding 300 pounds per square inch at 115°F.), inhibited	Notes 18 and 21	112A400W, 114A-400W Notes 4 and 20.
Carbon dioxide, liquefied	Note 5	105A500-W, Note 6.
Chlorine	125	106A500-X, Note 7.
	125	105A-500-W, Note 12.
Crude nitrogen fertilizer solution	Note 21	106A500-X, 105A300-W, 109A300-W, Note 20.
Crude nitrogen fertilizer solution (pressure not exceeding 75 pounds per square inch at 105°F.)	Note 21	106A500-X, 105A100-AL-W, 109A100-AL-W, Note 20.
Dichlorofluoromethane; Note 13	119	106A500-X, 110A-500-W, Note 7.
	125	105A300-W.
Dichlorodifluoromethane and difluoroethane mixture (constant boiling mixture); Note 13	Note 21	106A500-X, 110A500-W, Note 7. 105A300-W.
Dichlorodifluoromethane-dichlorotetrafluoroethane mixture; Note 13 .	119	106A500-X, 110A500-W, Note 7.
	125	105A300-W.
Dichlorodifluoromethane-monochlorodifluoromethane mixture; Note 13 .	119	106A500-X, 110A500-W, Note 7.
	125	105A300-W.
Dichlorodifluoromethane-monofluorotrichloromethane mixture; Note 13	Note 22	106A500-X, 110A500-W, Note 7. 105A300-W.

[1] Use of existing tank cars authorized, but new construction not authorized.

Kind of gas	Maximum permitted filling density Note 1	Required tank car, see § 73.31 (a)(2) and (3)
	Per cent	
Dichlorodifluoromethane-trichloromonofluoromethane-monochlorodifluoromethane mixture; Note 13	119 125	106A500-X, 110A500-W, Note 7. 105A300-W.
Dichlorodifluoromethane-trichlorotrifluoro-methane mixture; Note 13	119 125	106A500-X, 110A500-W, Note 7. 105A300-W.
Difluoroethane	79 84	106A500-X, 110A500-W, Note 7. 105A300-W. Note 23.
Difluoromonochloroethane; Note 13	100	106A500-X, 110A500-W, Note 7. 105A100-W, Note 4. Note 23.
Dimethylamine, anhydrous	59 62	106A500-X. 105A300-W, Note 4. Note 23.
Dimethyl ether	59 62	106A500-X, 110A500-W. 105A300-W, Note 4. Note 23.
Fertilizer ammoniating solution containing free ammonia	Note 21	106A500-X. 105A300-W, 109A300-W, Note 20.
Fertilizer ammoniating solution containing free ammonia (pressure not exceeding 75 pounds per square inch at 105°F.)	Note 21	106A500-X. 105A100-AL-W, 109A100-AL-W, Note 20.
Fertilizer ammoniating solution containing free ammonia (pressure not exceeding 150 pounds per square inch at 105°F.)	Note 21	106A500-X. 105A200-AL-W, Note 20.
Helium	Note 20	107A.
Hexafluoropropylene	110	106A500-X, 110A500-W, Note 7.
Hydrogen	Note 20	107A, Note 2.
Hydrogen sulphide	68	106A800-X, Notes 7 and 8.
Liquid hydrocarbon gas (pressure not exceeding 75 pounds per square inch at 105°F.)	Note 21	ICC-105A100[1], 105A100-W, 111A-100-W-4, Note 4. Note 23.
Liquid hydrocarbon gas (pressure not exceeding 225 pounds per square inch at 105°F.)	Note 21	105A300-W, Note 4. Note 23.
Liquid hydrocarbon gas (pressure not exceeding 300 pounds per square inch at 105°F.)	Note 21	105A-400-W, Note 4. Note 23.
Liquid hydrocarbon gas (pressure not exceeding 375 pounds per square inch at 105°F.)	Note 21	105A500-W, Note 4. Note 23.
Liquid hydrocarbon gas (pressure not exceeding 225 pounds per square inch at 130°F.)	Note 21	106A500-X.
Liquid hydrocarbon gas (pressure not exceeding 450 pounds per square inch at 105°F.)	Note 21	105A600-W, Note 4. Note 23.
Liquefied petroleum gas (pressure not exceeding 75 pounds per square inch at 105°F.)	Note 18	ICC-105A100[1], 105A100-W, 111A100-W-4. Note 4. Note 23.
Liquefied petroleum gas (pressure not exceeding 150 pounds per square inch at 105°F.)	Note 18	105A200-W, 105A200AL-W, Note 4. Note 23.
Liquefied petroleum gas (pressure not exceeding 225 pounds per square inch at 105°F.)	Note 18	105A300-W, Notes 4 and 20. Note 23.
Liquefied petroleum gas (pressure not exceeding 225 pounds per square inch at 115°F.)	Note 18	112A340-W, 114A340-W, Notes 4 and 20.
Liquefied petroleum gas (pressure not exceeding 300 pounds per square inch at 105°F.)	Note 18	105A400-W, Notes 4 and 20. Note 23.
Liquefied petroleum gas (pressure not exceeding 300 pounds per square inch at 115°F.)	Note 18	112A400F, 112A400-W, 114A400W, Notes 4 and 20.
Liquefied petroleum gas (pressure not exceeding 375 pounds per square inch at 105°F.)	Note 18	105A500-W, Notes 4 and 20. Note 23.
Liquefied petroleum gas (pressure not exceeding 375 pounds per square inch at 130°F.)	Note 18	106A500-X.
Liquefied petroleum gas (pressure not exceeding 450 pounds per square inch at 105°F.)	Note 18	105A600-W, Notes 4 and 20. Note 23.
Methylacetylenepropadiene, stabilized	Note 22	105A300-W, 112A-340-W, 114A340-W, 106A500-X, Notes 4 and 9. Note 23.
Methyl chloride	84 86	106A500-X, 110A500-W, Note 7. 105A300-W, Note 4. Note 23.
Methyl chloride-methylene chloride mixture	Note 22	106A500-X. 105A300-W, Note 4. Note 23.
Methyl mercaptan	80 82	106A500-X, Note 14. 105A300-W, Note 4. Note 23.
Monobromotrifluoromethane	124	110A800-W, Note 13.
Monochlorodifluoromethane; Note 13	105 110	106A500-X, 110A500-W. 105A300-W.
Monochlorotetrafluoroethane; Note 13	125	106A500-X, 110A500-W.
Monomethylamine, anhydrous	60 62	106A500-X. 105A300-W, Note 4.
Nitrogen	Note 20	107A.
Nitrogen fertilizer solution	Note 21	106A500-X. 105A300-W, 109A300-W, 109A300-AL-W, Note 20.
Nitrogen fertilizer solution (pressure not exceeding 75 pounds per square inch at 105°F.)	Note 21	106A500-X. 105A100-AL-W, 109A100-AL-W, Note 20.
Nitrosyl chloride	110 124	106A800-X, Note 11. 105A300-W, Note 10.
Oxygen	Note 20	107A.
Sulphur dioxide	125	106A500-X, 110A500-W. 105A200-W.

[1] Use of existing tank cars authorized, but new construction not authorized.

Kind of gas	Maximum permitted filling density Note 1	Required tank car, see § 73.31 (a)(2) and (3)
	Per cent	
Sulphuryl fluoride	12	105A500-W.
Trifluorochlorethylene	115	106A500-X, 110A500-W.
	120	105A300-W,Note 4. Note 23.
Trimethylamine, anhydrous	57	106A500-X.
	59	105A300-W, Note 4. Note 23.
Vinyl chloride; Note 9	84	106A500-X, Note 7.
	87	105A200-W, Notes 4 and 16. Note 23.
	86	112A340-W, Note 4.
Vinyl fluoride, inhibited	58	105A600-W, Note 17. Note 23.
Vinyl, methyl, ether inhibited; Note 9	68	ICC-105A100[1], 105A100-W, Note 4. Note 23.
	68	106A500-X, Note 7.

NOTE 1: The filling density for liquefied gases is hereby defined as the per cent ratio of the weight of gas in the tank to the weight of water that the tank will hold measured at 60°F.

NOTE 2: Each tank must be equipped with one or more safety relief devices of approved type and discharge area; the discharge outlet of each safety relief device must be connected to a manifold having an unobstructed discharge area of at least one and one-half times the total discharge area of the safety relief devices connected to the manifold; all manifolds must be connected to a single common header having an unobstructed discharge outlet pointing upward and extending above top of the car; the header and the header outlet must each have an unobstructed discharge area at least equal to the total discharge area of the manifolds connected to the header; the header outlet must be equipped with an approved ignition device which will instantly ignite any hydrogen discharged through the safety relief device.

NOTE 3: (Cancelled).

NOTE 4: For tank cars other than 106A class used for the transportation of liquefied flammable gases, interior pipes of loading and unloading valves must be equipped with excess-flow valves of approved design.

NOTE 5: The liquid portion of the gas at 0°F. must not completely fill the tank.

NOTE 6: Tank must be insulated with an approved material of a thickness so that the thermal conductance is not more than 0.03 b.t.u. per square foot, per degree F. differential in temperature per hour; except that the insulation thickness directly over the centre sills may be reduced to give thermal conductance not exceeding 0.04 b.t.u. per square foot, per degree F. differential in temperature per hour; this reduction is to permit an anchorage which must not exceed seven inches from top of centre sills to bottom of tank. Tank must be equipped with one safety relief valve of approved design set to open at a pressure not exceeding three-fourths of the test pressure of the tank and one frangible disc of approved design set to function at a pressure less than the test pressure of the tank. The discharge capacity of each of these safety relief devices must be sufficient to prevent building up of pressure in tank in excess of three-fourths of the test pressure of the tank. Tanks must be equipped with two pressure-regulating valves of approved design set to open at a pressure not to exceed 350 psi on 105A-500-W tanks and at a pressure not to exceed 400 psi on 105A600-W tanks. Each regulating valve and safety relief device must have its final discharge piped to the outside of the protective housing.

NOTE 7: Spec. 106A or 110A tanks authorized only for transportation by rail freight. (See § 74.560 for special requirements).

NOTE 8: Each tank must be equipped with adequate safety relief devices of the fusible plug type having a yield temperature not over 170°F., nor less than 157°F. Each device must be resistant to extrusion of the fusible alloy and leak tight at 130°F. Each valve outlet must be sealed by a threaded cap or a threaded solid plug. In addition all valves must be protected by a metal cover.

NOTE 9: All parts of valves and safety relief devices in contact with content of tank must be of a metal or other material suitably treated if necessary, which will not cause formation of any acetylides.

NOTE 10: Tanks must be made of or clad with a metal not subject to rapid deterioration by the lading, all appurtenances such as manhole covers, venting, loading and discharge valves, safety relief valves, check valves, and eduction pipes, must be made of metal not subject to rapid deterioration by the lading; cork must be used as an insulating material.

NOTE 11: Tanks of nitrosyl chloride shall be nickel-clad and safety relief devices shall be of the fusible plug type and shall function at a temperature of not exceeding 175°F. and be vapour tight at 130°F.

NOTE 12: For special tank requirements applying to chlorine, see § 79.102.2. The quantity of chlorine loaded into a single-unit tank car must not exceed 90 tons. Nominal 16 -, 30 -, 55 -, 85 -, or 90-ton tank car tanks must not be loaded in excess of the nominal lading weights. Tank cars built to ICC 105A500-W may be stencilled either 105A300 or 5A500; tank cars built to ICC or CTC-105A500-W may be stencilled either 105A300-W or 105A500-W; each tank must be equipped with the safety relief valve required by the stencilled specification. Existing tank cars, not larger than 30-ton chlorine capacity built to ARA-V, or not larger than 55 ton chlorine capacity built to 105A300, or 105A300-W, may be continued in service if equipped with excess flow valves in accordance with § 79.102.2. ARA-V and 105A cars having forge welded anchors must not be used for the transportation of chlorine.

NOTE 14: Container shall not be equipped with safety relief devices of any description

[1]Use of existing tank cars authorized, but new construction not authorized.

NOTE 15: A filling density of 58.8 per cent may be used during the months of November through March, inclusive. When this filling density is used, tank cars must be loaded and shipped directly to consumers for unloading. Storage in transit is not permitted

NOTE 16: Openings in tank heads to facilitate application of nickel lining are authorized and must be closed in an approved manner.

NOTE 17: Tank must be insulated with an approved material of a thickness so that the thermal conductance is not more than 0.03 b.t.u. per square foot per degree F. differential in temperature per hour except that the insulation thickness directly over centre sills may be reduced to give thermo conductance not exceeding 0.04 b.t.u. per square foot per degree F differential in temperature per hour; this reduction is to permit an anchorage which must not exceed seven inches from top of centre sills to bottom of tank. In addition to the safety relief valves required by a § 79.100-15 the tank must be equipped with one frangible disc of approved design set to function at a pressure less than 600 pounds per square inch but not less than 450 pounds per square inch. The discharge capacity of each of these safety relief devices must be sufficient to prevent building up of pressure in tank in excess of 495 pounds per square inch. Each safety relief device must have its discharge piped to the outside of the protective housing. The temperature of the vinyl fluoride, inhibited when the car is offered in transportation shall not exceed zero degrees F. and the pressure shall not exceed 105 psi. The shipper shall notify the Commission whenever a car is not received by the consignee within 30 days from the date of shipment

NOTE 18: See paragraph (f) of this section.

NOTE 19: See paragraph (f) (2) of this section.

NOTE 20: Liquid oxygen only may be transported by Tank cars authorized for such service by the AAR provided that all conditions prescribed by the AAR for such cars are fully complied with. Portable tanks installed permanently in box cars approved by the AAR for liquid oxygen service are deemed to be, for the purpose of this note, tank cars.

NOTE 21: See paragraph (d) (2) of this section.

NOTE 22: See paragraph (d) of this section

NOTE 23: After December 31, 1987, each specification 105 tank car built before September 1, 1981 and with a water capacity (shell full volume, including manways) exceeding 18,500 U.S. gallons shall conform to class CTC-105J. After December 31, 1987, each specification 111 tank car with a water capacity (shell full volume, including manways) exceeding 18,500 U.S. gallons shall conform to class CTC-111J. A 111J specification tank car tank must comply with the requirements of a 105J tank car tank as described in sections 79.100-15, 79.100 23, and 79.100-24 Specification 111 tank cars built after March 1, 1984 are not authorized for the transportation of flammable gases.

NOTE 24: After December 31, 1986, each specification 105 tank car built before September 1, 1981, and with a water capacity (shell full volume including manways) exceeding 18,500 U.S. gallons, shall conform to class CTC-105S.

(d) Filling limits.

(1) Non-liquefied and liquefied gas. The gas pressure at 105°F. in any insulated tank car tank of the CTC-105A and 109A-W class or spec. CTC-111A100-W-4; at 115°F. in any uninsulated tank car tank of the CTC-112A-W and 114A-W class; or at 130°F. in any uninsulated tank car tank of the CTC-106A and 110A-W class must not exceed three-fourths times the prescribed retest pressure of the tank. The gas pressure at 130°F. in any uninsulated tank car tank of the CTC-107A series must not exceed seven-tenths of the marked test pressure of the tank.

NOTE 1: 107A tanks may be charged with helium to a pressure 10% in excess of the marked maximum gas pressure at 130°F. of each tank.

(2) Liquefied gas. In addition to the requirements of paragraph (d) (1) of this section, the liquid portion of the gas at 105°F. must not completely fill an insulated tank, nor at 130°F. must not completely fill an uninsulated tank with the exception that the liquid portion of the gas at 115°F. must not completely fill an uninsulated tank car tank of the CTC-112A-W and 114A-W classes.

(e) Verification of content. The amount of liquefied gas loaded into each tank may be determined either by measurement or calculation of the weight. If by measurement, the weight must be checked after disconnecting the loading line by the use of proper scales. If by calculation, the weight of liquefied petroleum gas, methylacetylene-propadiene, stabilized, dimethylamine, monomethylamine, or trimethylamine may be calculated using the outage tables supplied by the tank car owner and specific gravities as determined at the plant, and this computation must be checked by determination of specific gravity of product after loading. Carriers may verify calculated weights by use of proper scales.

(f) Special requirements for liquefied petroleum gas and butadiene tank cars.

(1) Single unit tank cars. Maximum filling density in single unit tank cars shall be as shown in the following table:

Specific gravity at 60°F.	Maximum permitted filling density			
	Insulated cars		Uninsulated cars	
	April through October	November through March (See Note 1)	April through October	November through March (See Note 1)
0.500	45.500	47.40	44.88	46.88
0.501	45.600	47.51	45.00	47.00
0.502	45.700	47.62	45.13	47.10
0.503	45.800	47.73	45.25	47.20
0.504	45.900	47.84	45.38	47.30
0.505	46.000	47.95	45.50	47.40
0.506	46.125	48.06	45.60	47.50
0.507	46.250	48.17	45.70	47.63
0.508	46.375	48.28	45.80	47.75
0.509	46.500	48.39	45.90	47.88
0.510	46.750	48.51	46.00	48.00
0.511	47.000	48.61	46.13	48.10
0.512	47.125	48.72	46.25	48.20
0.513	47.250	48.83	46.38	48.30
0.514	47.375	48.94	46.50	48.40
0.515	47.500	49.05	46.63	48.50
0.516	47.625	49.16	46.75	48.63
0.517	47.750	49.27	46.88	48.75
0.518	47.875	49.38	47.00	48.88
0.519	48.000	49.49	47.13	49.00
0.520	48.125	49.60	47.25	49.10
0.521	48.250	49.70	47.38	49.20
0.522	48.375	49.81	47.50	49.30
0.523	48.500	49.92	47.63	49.40
0.524	48.600	50.03	47.75	49.50
0.525	48.700	50.14	47.88	49.63
0.526	48.800	50.25	48.00	49.75
0.527	48.900	50.36	48.13	49.88
0.528	49.000	50.47	48.25	50.00
0.529	49.125	50.58	48.38	50.10
0.530	49.250	50.69	48.50	50.20
0.531	49.375	50.79	48.63	50.30
0.532	49.500	50.90	48.75	50.40
0.533	49.625	51.01	48.88	50.50
0.534	49.750	51.12	49.00	50.63
0.535	49.875	51.23	49.13	50.75
0.536	50.000	51.34	49.25	50.88
0.537	50.100	51.45	49.38	51.00
0.538	50.200	51.56	49.50	51.10
0.539	50.300	51.67	49.60	51.20
0.540	50.400	51.78	49.70	51.30
0.541	50.500	51.88	49.80	51.40
0.542	50.625	51.99	49.90	51.50
0.543	50.750	52.09	50.00	51.63
0.544	50.875	52.20	50.13	51.75
0.545	51.000	52.31	50.25	51.88
0.546	51.100	52.41	50.38	52.00
0.547	51.200	52.52	50.50	52.10
0.548	51.300	52.62	50.63	52.20
0.549	51.400	52.73	50.75	52.30
0.550	51.500	52.84	50.88	52.40
0.551	51.625	52.94	51.00	52.50
0.552	51.750	53.05	51.13	52.63
0.553	51.875	53.16	51.25	52.75
0.554	52.000	53.26	51.38	52.88
0.555	52.125	53.37	51.50	53.00
0.556	52.250	53.48	51.60	53.10
0.557	52.375	53.58	51.70	53.20
0.558	52.500	53.69	51.80	53.30
0.559	52.625	53.80	51.90	53.40
0.560	52.750	53.91	52.00	53.50
0.561	52.875	54.01	52.13	53.63
0.562	53.000	54.12	52.25	53.75
0.563	53.100	54.22	52.38	53.88
0.564	53.200	54.33	52.50	54.00
0.565	53.300	54.43	52.63	54.10
0.566	53.400	54.54	52.75	54.20
0.567	53.500	54.64	52.88	54.30
0.568	53.600	54.75	53.00	54.40
0.569	53.700	54.85	53.10	54.50
0.570	53.800	54.96	53.20	54.60
0.571	53.900	55.06	53.30	54.70
0.572	54.000	55.17	53.40	54.80
0.573	54.125	55.27	53.50	54.90
0.574	54.250	55.38	53.63	55.00
0.575	54.375	55.48	53.75	55.13
0.576	54.500	55.59	53.88	55.25
0.577	54.600	55.69	54.00	55.38
0.578	54.700	55.80	54.10	55.50
0.579	54.800	55.90	54.20	55.60
0.580	54.900	56.01	54.30	55.70
0.581	55.000	56.11	54.40	55.80
0.582	55.100	56.22	54.50	55.90
0.583	55.200	56.32	54.63	56.00
0.584	55.300	56.43	54.75	56.13
0.585	55.400	56.53	54.88	56.25
0.586	55.500	56.64	55.00	56.38
0.587	55.625	56.74	55.13	56.50
0.588	55.750	56.85	55.25	56.60
0.589	55.875	56.95	55.38	56.70
0.590	56.000	57.06	55.50	56.80
0.591	56.090	57.15	55.60	56.90
0.592	56.180	57.25	55.70	57.00
0.593	56.270	57.34	55.80	57.10
0.594	56.360	57.44	55.90	57.20
0.595	56.450	57.53	56.00	57.30
0.596	56.540	57.63	56.13	57.40
0.597	56.630	57.72	56.25	57.50
0.598	56.720	57.82	56.38	57.60
0.599	56.810	57.91	56.50	57.70
0.600	56.900	58.01	56.62	57.80
0.601	56.990	58.10	56.73	57.90
0.602	57.080	58.20	56.84	58.00
0.603	57.170	58.29	56.95	58.13
0.604	57.260	58.39	57.07	58.25
0.605	57.350	58.49	57.18	58.38
0.606	57.440	58.58	57.30	58.50
0.607	57.530	56.68	57.41	58.63
0.608	57.620	58.77	57.52	58.75
0.609	57.710	58.87	57.64	58.88
0.610	57.800	58.97	57.76	59.00
0.611	57.890	59.06	57.87	59.10
0.612	57.980	59.16	57.98	59.20
0.613	58.070	59.26	58.09	59.30
0.614	58.160	59.35	58.21	59.40
0.615	58.250	59.45	58.32	59.50
0.616	58.340	59.55	58.43	59.63
0.617	58.430	59.64	58.55	59.75
0.618	58.520	59.74	58.66	59.88
0.619	58.610	59.84	58.77	59.97
0.620	58.700	59.94	58.89	60.07
0.621	58.790	60.03	59.00	60.18
0.622	58.880	60.13	59.12	60.28
0.623	58.970	60.23	59.23	60.38
0.624	59.060	60.32	59.34	60.49
0.625	59.150	60.42	59.46	60.59
0.626	59.240	60.52	59.57	60.70
0.627	59.330	60.61	59.68	60.80
0.628	59.420	60.71	59.80	60.90
0.629	59.510	60.81	59.91	61.01
0.630	59.600	60.91	60.02	61.11
0.631	59.690	61.00	60.13	61.18
0.632	59.780	61.10	60.28	61.28
0.633	59.870	61.19	60.34	61.38
0.634	59.960	61.29	60.44	61.47
0.635	60.050	61.39	60.55	61.57

NOTE 1: When these filling densities are used, tank cars must be shipped directly to consumers for unloading. Storage in transit is not permitted.

(2) 106A class tank cars. Maximum filling density in 106A class tank cars shall be as shown in § 73.304(d)(1).

(g) Foreign tank cars in domestic use. Except as authorized by § 73.8 tank cars made in foreign countries, except the United States, must not be used in domestic traffic until they have been tested in this country and proper reports rendered as required by the specifications that apply.

(h) Odorization. Liquefied petroleum gases shall be effectively odorized as required in Note 2 of this subsection to indicate positively, by a distinctive odor, the presence of the gas down to a concentration in air of not over one-fifth the lower limit of combustibility, provided, however, that odorization is not required if harmful in the use or further processing of the liquefied petroleum gas, or if odorization will serve no useful purpose as a warning agent in such use or further processing.

NOTE 1: The lower limits of combustibility of the more commonly used liquefied petroleum gases are: Propane — 2.15 per cent, Butane — 1.55 per cent. These figures represent volumetric percentages of gas-air mixtures in each case.

NOTE 2: The use of 0.5 kg. of ethyl mercaptan, 0.5 kg of thiophane, or 0.75 kg of amyl mercaptan per 36,000 litres of liquefied petroleum gas shall be considered sufficient to meet the requirements of 73.314(h). (This note does not exclude the use of any other odorant in sufficient quantity to meet the requirements of 73.314(h).)"

§ 73.315 Compressed gases in portable tank containers. (a) Portable tank containers must not contain gases capable of combining chemically.

(1) Compressed gases must not be shipped in portable tank containers except as provided in this section and § 73.32 of this part, and in the following table.

Kind of Gas	Maximum Permitted Filling Density		Specification Container Required	
	Per cent by weight (See Note 1)	Per cent by volume (See par. (f) of this section)	Type (See Note 2	Minimum design pressure (psig)
Anhydrous ammonia	56	82 See Note 5	CTC 51	265
Anhydrous dimethylamine	59	See Note 7	CTC 51	150
Anhydrous monomethylamine	60	See Note 7	CTC 51	150
Anhydrous trimethylamine	57	See Note 7	CTC 51	150
Butadiene inhibited	See par. (b) of this section	See par. (b) of this section	CTC 51	100
Carbon dioxide, liquefied	See par. (c) of this section	95	CTC 51	200; See Note 3.
Dichlorodifluoromethane (See Note 9)	119	See Note 7	CTC 51	150
Dichlorodifluoromethane-dichlorotetrafluorocthane mixture (See Note 9)	119	See Note 7	CTC51	150
Dichlorodifluoromethane-monofluorotrichloromethane mixture (See Note 9)	See par. (c) of this section	See Note 7	CTC 51	150
Liquefied petroleum gas	See par. (b) of this section	See par. (b) of this section	CTC 51	See subpar. (c)(1)
Methylacetylene-propadiene, stabilized (See Note 13)	53	90	CTC 51	200
Methyl chloride	84	88.5	CTC 51	150
Methyl chloride (optional portable tank 2,000 pounds water capacity fusible plug)	84	See Note 6	CTC 51	225
Methyl mercaptan	80	90	CTC 51	100
Monochlorodifluoromethane	105	See Note 7	CTC 51	250
Nitrous oxide (See Note 9) See par. (c) of this section	95	CTC 51	200; See Note 3	
Sulphur dioxide (tanks not over 1,200 gallons water capacity).	125	87.5	CTC 51	150; See Note 4.
Sulphur dioxide (tanks over 1,200 gallons water capacity).	125	87.5	CTC 51	125; See Note 4.
Sulphur dioxide (optional portable tank 1,000-2,000 pounds water capacity, fusible plug)	125	See Note 6	CTC 51	225

NOTE 1: Maximum filling density for liquefied gases is hereby defined as the per cent ratio of the weight of gas in the tank to the weight of water that the tank will hold. For determining the water capacity of the tank in pounds, the weight of a gallon (277.3 cubic inches) of water at 60°F. in air shall be 10.0 pounds.

NOTE 2: See § 73.32 of this part for authority to use containers made prior to May 15, 1950.

NOTE 3: If portable tank containers for carbon dioxide and nitrous oxide are designed to comply with the requirements of the ASME code for Low Temperature Operation, the design pressure may be reduced to 100 psig or the controlled pressure, whichever is greater.

NOTE 4: In the design of tanks for sulphur dioxide and chlorine a corrosion allowance of 20 percent or 0.10 inch, whichever is less, must be added to the metal thickness. In chlorine tanks the wall thickness must be at least five-eights inch, including corrosion allowance.

NOTE 5: Unlagged portable tank containers for liquid anhydrous ammonia may be filled to 87.5 per cent by volume provided the temperature of the anhydrous ammonia being loaded into such tanks is determined to be not lower than 30°F, or provided the filling of such tanks is stopped at the first indication of frost or ice formation on the outside surface of the tank and is not resumed until such frost or ice has disappeared.

NOTE 6: Tanks equipped with fusible plugs must be filled by weight.

NOTE 7: Tanks must be filled by weight.

NOTE 13: All parts of valves and safety devices in contact with contents of tank must be of a metal or other material suitably treated if necessary, which will not cause formation of any acetylides.

(b) Maximum permitted filling densities for portable tank containers for transportation of butadiene, inhibited, and liquefied petroleum gases are as follows:

Maximum specific gravity of the liquid material at 60°F.	Maximum permitted filling density in per cent of the water-weight capacity of the tanks		Maximum permitted filling density by volume
	1,000 gallons or less	Over 1,000 gallons	
	Per cent	Per cent	
0.473—0.480	38	41	see note 1
0.481—0.488	39	42	
0.489—0.495	40	43	
0.496—0.503	41	44	
0.504—0.510	42	45	
0.511—0.519	43	46	
0.520—0.527	44	47	
0.528—0.536	45	48	
0.537—0.544	46	49	
0.545—0.552	47	50	
0.553—0.560	48	51	
0.561—0.568	49	52	
0.569—0.576	50	53	
0.577—0.584	51	54	
0.585—0.592	52	55	
0.593—0.600	53	56	
0.601—0.608	54	57	
0.609—0.617	55	58	
0.618—0.626	56	59	
0.627 and over	57	60	

NOTE 1: Same filling density as permitted by weight, except when using fixed length dip tube or other fixed maximum liquid level indicators (paragraph (f) of this section), in which case the maximum permitted filling density shall not exceed 97 per cent of the maximum permitted filling density by weight contained in the table.

(1) Odorization. All liquefied petroleum gas shall be effectively odorized as required in Note 2 of this paragraph to indicate positively, by a distinctive odor, the presence of gas down to a concentration in air of not over one-fifth the lower limit of combustibility, provided, however, that odorization is not required if harmful in the use of further processing of the liquefied petroleum gas, or if odorization will serve no useful purpose as a warning agent in such use or further processing.

NOTE 1: The lower limits of combustibility of the more commonly used liquefied petroleum gases are: Propane, 2.15 per cent: Butane, 1.55 per cent. These figures represent volumetric percentages of gas-air mixtures in each case.

NOTE 2: The use of 1.0 pound of ethyl mercaptan, 1.0 pound of thiophane, or 1.4 pounds of amyl mercaptan per 10,000 gallons of liquefied petroleum gas shall be considered sufficient to meet the requirements of § 73.315(b)(1). (This note does not exclude the use of any other odorant in sufficient quantity to meet the requirements of §73.315(b)(1).)

(c) The loading of liquefied gases into portable tank containers shall be determined by weight or by suitable liquid level gauging device. In either case the liquid portion of the gas shall not fill the tank at 105°F. if the tank be lagged, nor at 115°F. if the tank be unlagged, except that this requirement shall be waived for the shipment of carbon dioxide and nitrous oxide in tanks (which are required to be equipped with suitable pressure controlling devices) which may be charged to a level corresponding to 95 per cent of the volumetric capacity of the tank.

(1) The vapour pressure (psig) at 115°F. must not exceed the design pressure of the cargo tank or portable tank container.

(d) If the loading of portable tank containers with liquefied gases is to be determined by weight, the gross weight shall be checked after the filling line is disconnected in each instance. The gross weight shall be calculated from the tank capacity and tare weight set forth on the metal plate required by the specification, and the maximum filling density permitted for the material being loaded into the tank as set forth in the table, paragraph (a)(1) of this section.

(e) If the loading of portable tank containers with liquefied gases is to be determined by adjustable liquid level device, each tank and each compartment thereof shall have a thermometer well, so that the internal liquid temperature can easily be determined, and the amount of liquid in the tank shall be corrected to a 60°F. basis. Liquid levels shall not exceed a level corresponding to the maximum filling density permitted for the material being loaded into the tank as set forth in the table in paragraph (a)(1) of this section.

(f) When the loading of portable tank containers with liquefied gases is determined only by fixed length dip tube or other fixed maximum liquid level indicator, the device shall be arranged to function at a level not to exceed the maximum permitted volume prescribed by the table, paragraph (a)(1) of this section. Loading shall be stopped when the device functions.

(h) Each portable tank container, except tanks filled by weight, shall be equipped with one or more of the following gauging devices which indicate accurately the maximum permitted liquid level: (Additional gauging devices may be installed but may not be used as primary controls for filling of portable tank containers. Gauge glasses shall not be permitted to be installed on portable tank container).

(1) The design pressure of the liquid level gauging devices shall be at least equal to the design pressure of the tank.

(2) All liquid level gauging devices, except on tanks provided with fixed maximum level indicators, shall be legibly and permanently marked in increments of not more than 20°F. to indicate the maximum levels to which the tank may be filled with liquid at temperatures above 20° F. except that gauging devices on tanks for carbon dioxide and nitrous oxide may be marked in increments of not more than 25 psig. In the event that it is impracticable to put these markings on the gauging device, this information shall be marked on a suitable plate affixed to the tank in location adjacent to the gauging device.

Kind of gas	Permitted gauging device
Anhydrous ammonia	Rotary tube; adjustable slip tube; fixed length dip tube.
Anhydrous dimethylamine	None.
Anhydrous monomethylamine	None.
Anhydrous trimethylamine	None.
Aqua ammonia solution containing anhydrous ammonia	Rotary tube; adjustable slip tube; fixed length dip tube
Butadiene, inhibited	Rotary tube; adjustable slip tube; fixed length dip tube.
Carbon dioxide, liquefied	Rotary tube; adjustable slip tube; fixed length dip tube.
Chlorine	None.
Dichlorodifluoromethane	None.
Dichlorodifluoromethane and difluoroethane mixture (constant boiling mixture)	None.
Dichlorofluoromethane-dichlorotetrafluoroethane mixture	None.
Dichlorodifluoromethane-monofluorotrichloromethane mixture	None.
Difluoromonochloroethane	None.
Hexafluoropropylene	None.
Liquefied petroleum gases	Rotary tube, adjustable slip tube; fixed length dip tube.
Methylacetylenepropadiene, stabilized	Rotary tube; adjustable slip tube; fixed length dip tube.
Methyl chloride	Fixed length dip tube.
Methyl mercaptan	Rotary tube; adjustable slip tube; fixed length slip tube.
Monochlorodifluoromethane	None.
Nitrous oxide	Rotary tube; adjustable slip tube; fixed length dip tube.
Sulphur dioxide	Fixed length dip tube.
Vinyl chloride	None.
Vinyl fluoride, inhibited	None.

(3) Liquid level gauging devices which are so constructed that the outward flow of tank contents exceeds that passed by a No. 54 drill size opening, shall be equipped with excess-flow valves. Exception: Not required on gauging devices when used on tanks in carbon dioxide service.

(4) A fixed-length dip tube gauging device, when used, shall consist of a dip pipe of small diameter equipped with a valve at the outer end, and extending into the tank to a specified fixed length. On horizontally mounted cylindrical tanks the fixed length to which the tube extends into the tank shall be such that the device will function to indicate when the liquid at a point equidistant from the heads of the tank in a vertical plane containing the longitudinal axis of the tank, reaches the maximum level permitted by this section except that on tanks for liquified petroleum gases the device should be set to function when the liquid reaches the maximum level at 40°F. when charged in accordance with the authorized filling density. On spherical tanks and on vertically mounted cylindrical tanks the fixed length to which the tube extends into the tank shall be such that the device will function to indicate when the liquid at a point on the vertical axis of the tank in its normal position reaches the maximum level permitted by this section except that on tanks for liquefied petroleum gases the device should be set to function when the liquid reaches the maximum level at 40°F. when charged in accordance with the authorized filling density.

(i) Each tank shall be provided with one or more safety devices which, unless otherwise specified, shall be safety relief valves of the springloaded type and they shall be arranged to

discharge upward and unobstructed to the outside of the protective housing in such a manner as to prevent any impingement of escaping gas upon the tank, except that for chlorine tanks these shall be a protective housing and cover plate conforming to the Chlorine Institute Drawing 137-1 dated November 7, 1962 to permit the use of standard emergency kits for controlling leaks in fittings on the dome cover plate.

(1) Safety relief valves on any tank shall be set to start-to-discharge at a pressure not in excess of 110 per cent of the design pressure of the tank and shall have a total relieving capacity sufficient to prevent a maximum pressure in the tank of more than 120 per cent of the design pressure, using the heat input as determined by Fetterly's formula.[1] The required relieving capacity of safety relief valves for lagged tanks shall be based upon the heat input to a bare tank, unless insulation is covered by a sheet metal jacket of not less than 16 gauge nominal thickness.

(2) The start-to-discharge pressure of safety relief valves shall be not less than the values given in the following table:

King of gas	Minimum start-to-discharge pressure (psig)
Anhydrous ammonia	265.
Anhydrous dimethylamine	150.
Anhydrous monomethylamine	150.
Anhydrous trimethylamine	150.
Aqua ammonia solution containing anhydrous ammonia	100.
Butadiene, inhibited	90
Carbon dioxide, liquefied	Not specified.
Chlorine	225
Dichlorodifluoromethane	150.
Dichlorodifluoromethane and difluoroethane mixture (constant boiling mixture)	250.
Dichlorodifluoromethane-dichlorotetrafluoroethane mixture	150
Dichlorodifluoromethane-monofluorotrichloromethane mixture	150
Difluoromonochloroethane	100.
Hexafluoropropylene	250.
Liquefied petroleum gases	90 per cent of the design pressure of tank.
Methylacetyleneпropadiene, stabilized	200.
Methyl chloride	150.
Methyl mercaptan	100.
Monochlorodifluoromethane	250.
Nitrous oxide	Not specified.
Sulphur dioxide:	
Up to 1,000 gallons water capacity tank	120.
Over 1,000 gallons water capacity tank	110
Vinyl chloride	150.
Vinyl, fluoride, inhibited	250.

(3) Each safety relief valve shall be plainly and permanently marked with the pressure in psig at which it is set to discharge, with the actual rate of discharge of the device in cubic feet per minute of the gas at 60°F. and atmospheric pressure, and with the manufacturer's name and catalogue number. The rated discharge capacity of the device shall be determined at a pressure of 120 per cent of the design pressure of the tank.

(4) Connections to safety relief valves shall be of sufficient size to provide the required rate of discharge through the safety relief valves.

(5) Safety relief valves shall be arranged so that the possibility of tampering will be minimized; and if the pressure setting or adjustment is external the safety relief valves shall be provided with suitable means for sealing the adjustment.

(6) No shut-off valves shall be installed between the safety relief valves and tank except, in cases where two or more safety relief valves are installed on the same tank, a shut-off valve may be used where the arrangement of the shut-off valve or valves is such as always to afford full required capacity flow through at least one safety relief valve.

(7) Safety relief valves shall have direct communication with the vapor space of the tank.

(8) Any portion of liquid piping or hose which at any time may be closed at each end must be provided with a safety relief valve to prevent excessive hydrostatic pressure. This safety relief valve must not have an intervening shut-off valve installed.

(9) Additional restrictions as specified in Notes 1,2 and 3 of this subparagraph apply to safety relief devices on tanks for carbon dioxide or nitrous oxide.

NOTE 1: The maximum operating pressure in the tank may be regulated by the use of one or more pressure controlling devices, which devices shall not be in lieu of the safety relief valve required in paragraph (i) of this section

NOTE 2: All safety devices shall be so installed and located that the cooling effect of the contents will not prevent the effective operation of the device

NOTE 3: In addition to safety relief valves required by paragraph (i) of this section each tank for carbon dioxide may be equipped with one or more frangible disc devices of suitable design set to function at a pressure not exceeding two times the design pressure of the tank

(10) Subject to conditions of subparagraph (a)(1) of this section for sulphur dioxide optional portable tank 1,000-2,000 pounds water capacity—225 psig, one or more fusible plugs approved by the Bureau of Explosives or the Commission may be used in lieu of safety relief valves of the spring-loaded type. The fusible plug or plugs shall have total relieving capacity as determined by the use of Fetterly's formula sufficient to prevent a pressure rise in the tank of more than 120 per cent of the design pressure. If the tank is over thirty inches long, both ends must have the total specified safety discharge area.

§ 73.316 Liquefied hydrogen. Liquefied hydrogen (minimum 95 per cent parahydrogen) must be charged into specification containers as follows:

(1) Spec. 113A60-W-2. Tank cars. Each tank car shall have a pressure controlling valve set at a pressure not exceeding 17 psig. The maximum permitted filling density is 6.6 per cent.

SUBPART G—POISONOUS SUBSTANCES

§ 73.327 Packing. (a) Cylinders must be maintained in compliance with the requirements of § 73.34. Valves must be capable of withstanding the test pressure of the cylinders and must have taper-threaded connections directly to the cylinders (no bushings or straight-threaded connections of valves to cylinders permitted). for corrosive commodities, valves may be of the packed type provided the assembly is made gas-tight by means of a seal cap with compatible gasketed joint to the valve body or to the cylinder to prevent loss of commodity through or past the packing; otherwise the valves must be of the packless type with non-perforated diaphragms and hand-wheels. Each valve outlet must be sealed by a threaded cap or a threaded solid plug. The outlet caps and plug, luting, and gaskets must be compatible with each other, the valve assembly, and the lading.

(1) The pressure of the poison gas at 130°F. must not exceed the service pressure of the cylinder. Cylinders must not be liquid full at 130°F.

(2) Cylinders packed in boxes must have adequate protection for valves. Box and valve protection must be of strength sufficient to protect all parts of cylinders and valves from deformation or breakage resulting from a drop of at least six feet onto a concrete floor, impacting at the weakest point. A cylinder not overpacked in a box must be equipped with a protective cap or other means of valve protection which must be capable of preventing damage to or distortion of the valve if it were subjected to an

[1] Copies of Fetterly's formula may be obtained from the Bureau of Explosives.

impact test as follows: The cylinder, prepared as for shipment, is allowed to fall from an upright position with the side of the cap or other valve protection striking a solid steel object projecting not more than six inches above the floor level.

(b) Closing and cushioning. All containers must be tightly and securely closed. Inside containers must be cushioned as prescribed, or in any case when necessary to prevent breakage or leakage.

(d) Poisonous gases shall not be transported in containers that are interconnected by any means.

§ 73.328 Poisonous gases and liquids not specifically provided for. (a) Poisonous gases and liquids, other than those for which special requirements are prescribed, must be packed in specification containers as follows:

(1)Spec. 33[1] or 3D[1]. Metal cylinders of not over 125 pounds water capacity (nominal). Gaskets if used between the protection cap and neck of cylinder must be renewed for each shipment even though they may appear to be in good condition. Cylinders not fitted with valve protection extension ring must be packed in wooden boxes.

(2) Spec. 3A1800, 3AA1800,3AL1800, or 3E1800 cylinders.

(i)Spec. 3A, 3AA, and 3AL cylinders must not exceed 125 pounds water capacity (nominal). Cylinders must have valve protection or be packed in strong wooden or metal boxes as described in § 73.327(a)(2).

(ii) Spec. 3E1800 cylinders must be packed in strong wooden or metal boxes.

(3) Cyanogen chloride containing less than 0.9 percent water may also be packaged as prescribed by § 73.332(a)(2).

§ 73.329 Bromacetone; chlorpicrin and methyl chloride mixtures; chlorpicrin and nonflammable, nonliquefied compressed gas mixtures. (a) Bromacetone, when offered for transportation by carriers by rail freight, must be packed in specification containers as follows:

(1) As prescribed in § 73.328.

(2) Spec. 15A, 15B, 15C, 16A, or 19B. Wooden boxes with inside glass bottles or tubes in hermetically sealed metal cans in corrugated fibreboard cartons, spec. 2C. Bottles must contain not over 1 pound of liquid each, must be filled to not over 95 per cent capacity, must be tightly and securely closed, and must be cushioned in cans with at least ½ inch of absorbent material. Cans must be made of metal at least 32 gauge United States standard. Total amount of liquid in outside box must not exceed 24 pounds.

(b) Chlorpicrin and methyl chloride mixtures. Chlorpicrin and methyl choride mixtures, in addition to containers prescribed in § 73.328, when offered for transportation by carriers by rail freight, may be shipped in specification containers as follows:

(1) Spec. 3A, 3AA, 3B, 3C, 3E, 4A, 4B, 4BA, 4BW, or 4C cylinders having not over 250 pounds water capacity (nominal). Valves or other closing devices must be protected to prevent damage in transit, by screw-on metal caps or by packing the cylinders in strong boxes or crates. Cylinders having a wall thickness of less than 0.10 inch must be packed in boxes or crates.

(c) Chlorpicrin and nonflammable, nonliquefied compressed gas mixtures. Chlorpicrin and nonflammable, nonliquified compressed gas mixtures, in addition to containers prescribed in § 73.328, when offered for transportation by carriers by rail freight, must be shipped in specification containers as follows:

(1) Spec. 3A, 3AA, 3B, 3C, 3E, 4A, 4B, 4BA, 4BW, or 4C cylinders having not over 250 pounds water capacity (nominal). Valves or other closing devices must be protected to prevent damage in transit, by screw-on metal caps or by packing the cylinders in strong boxes or crates. Cylinders having a wall thickness of less than 0.10 inch must be packed in boxes or crates.

§ 73.330 Chemical ammunition. (a) Projectiles, shells, bombs, and grenades containing poisonous gases or liquids, Packing Group I, but not equipped or packaged with ignition elements, bursting charges, detonating fuzes, or explosive components, may be shipped only by, for, or to the Department of National Defence. Each shipment must be packaged, marked, and labelled as required by their regulations. (See §§ 73.53(r) and 73.59 for explosive chemical ammunition.)

(b) Chemical ammunition containing poisonous liquids or gases, Packing Group I, must not be offered for transportation by rail express.

§ 73.331 Gas identification sets. (a) Gas identification sets containing poisonous liquids and gases, Packing Group I, and poisonous articles, Packing Group II and chlorine when offered for transportation by carriers by rail freight or rail express must be packed in spec. 15A, 15B, 19A, or 19B. Wooden boxes, under the following conditions:

(1) Gas identification sets containing poisonous liquids and gases, Packing Group I, and poisonous articles, Packing Group II may be shipped in amounts not exceeding 5 cubic centimeters if a liquid, or 5 grams, if a solid when mixed with or absorbed in activated charcoal or silica gel, or other absorbent medium, and packed in strong glass bottles of not less than 4-fluid-ounces capacity. The poisonous gases, and chlorine may be shipped if the gas itself is absorbed in activated charcoal or silica gel, or other absorbent medium, this material to be filled into 4-ounce bottles as above; each bottle as herein specified must be surrounded with appropriate absorbent cushioning material, and enclosed in a hermetically sealed metal can; each can must be surrounded on all sides by at least 1 inch of dry, fine sawdust or wood pulp; the cans must be packed in an outside wooden box, spec.15A, 15B, 19A, or 19B; the bottles must be closed with ground-in glass stoppers securely fastened; the cushioning material around the bottle must be at least 1 inch thick; the cans must be made from metal of thickness not less than 30 gauge, United States standards; and there must be not more than a total of 100 grams or cubic centimeters, or a combination of both, in each outside wooden box.

(b) Gas identification sets containing poisonous liquids or gases, Packing Group I or II, when offered for transportation by carriers by rail freight or rail express, must be packed for shipment as follows:

(1) The liquids or liquefied gases in hermetically sealed glass tubes containing not to exceed 40 cubic centimeters each; each tube securely cushioned and packed in an individual mailing tube with screw-thread metal cover; not more than 12 of such mailing tubes, cushioned with corrugated fibreboard, packed in a closed fibreboard container; and not to exceed 4 such fibreboard containers, containing an aggregate of not to exceed 48 glass tubes, cushioned and packed in an outside steel cylinder of not less than 0.145-inch wall thickness, which is closed by a plate, bolted to a flange, welded to cylinder wall. Suitable gasket shall be placed between flange and head plate, and closure shall

[1] Use of existing cylinders authorized, but new construction not authorized.

be such as to prevent leakage of any gas.

(c) Gas identification training sets containing poisonous liquids, Packing Group I, and poisonous articles, Packing Group II, when offered for transportation by carriers by rail freight or rail express, must be packed for shipment as follows:

(1) The poisonous liquid, Packing Group I, and poisonous articles, Packing Group II, in amounts not exceeding 5 cubic centimeters, if a liquid, or 20 grams, if a solid, when mixed with or absorbed in activated charcoal, silica gel, crepe rubber, or other absorbent medium, must be packed in strong glass bottles of not less than 2 fluid ounces capacity, equipped with a polyethylene liner; each bottle as herein specified must have a metal screw cap closure, equipped with a built-in compression type spring and an insert in the opening of the bottle to match so that when tightened an airtight seal is obtained. Twelve bottles, containing articles as described in this paragraph and not exceeding 100 cubic centimeters or grams, or a combination of both, shall be placed in a modified styrene plastic carrying case, in three rows of four bottles each and fitted with a fibreboard cell or separator. The void space around the individual bottles, and around all interior sides of the carrying case, shall be filled with dry, fine sawdust or vermiculite. A sheet of sponge rubber shall be fitted to the inside of the top and bottom of the carrying case to provide additional cushioning and insure a snug fit of the bottles when the top is secured. The carrying case shall be fitted into a snug fitting fibreboard box, domestic type. The case shall then be packed in a nailed wooden box, spec. 15A, 15B, 19A, or 19B which shall be fitted with a waterproof case liner.

§ 73.332 Hydrocyanic acid, liquid (prussic acid) and hydrocyanic acid liquefied. (a) Hydrocyanic acid, liquid (prussic acid) and hydrocyanic acid liquefied, must be packed in specification containers as follows:

(1) As prescribed in § 73.328.

(2) Spec. 3A480, 3AA480, 3A480X, or 3AL1800. Metal cylinders of not over 278 pounds water capacity (nominal); valve protection cap must be used and be at least 3/16 inch thick, gastight, with 3/16 inch faced seat for gasket and with United States standard form thread; the cap must be capable of preventing injury or distortion of the valve when it is subjected to an impact caused by allowing cylinder, prepared as for shipment, to fall from an upright position with side of cap striking a solid steel object projecting not more than 6 inches above floor level.

(b) Cylinders must be charged with not more than 0.6 pound of liquid for 1-pound water capacity of cylinder. Each filled cylinder must be tested for leakage before shipment and must show absolutely no leakage; this test must consist in passing over the closure of the cylinder, without the protection cap attached a piece of Guignard's sodium picrate paper to detect any escape of hydrocyanic acid from the cylinder. Other equally efficient test methods may also be used in lieu of the picrate paper.

(c) Liquid hydrocyanic acid completely absorbed in inert material may also be shipped in specification containers as follows:

(1)Spec. 15A, or 19B. Wooden boxes with inside containers consisting of metal cans, spec. 2N, not over 14 pounds water capacity each. The liquid contents of each can must not exceed 0.33 pound of liquid for 1-pound water capacity of the can. Each can containing 4 ounces or more of liquid must be fitted with fibre caps not less than 0.08 inch thick flanged about 1 inch and fitting snugly over each end of the can. Each can must be tested for leakage after being filled and again after being maintained at ordinary room temperature for a period of at least three weeks. Each can must have its outer surface protected against rust by the use of enamel or lacquer, or each can must be completely wrapped in waterproof paper.

(2) The box lining must consist of not more than two pieces of waterproof paper, one piece completely surrounding the contents and running lengthwise of the box, and the other piece completely surrounding the contents and running crosswise of the box. In each instance, the wrapping must overlap at least 4 inches.

(3) Spec. 12B. Fibreboard boxes, constructed in accordance with requirements for a gross weight of 65 pounds but having a gross weight of not over 70 pounds, with inside containers consisting of metal cans, spec. 2N. The liquid contents of each can must not exceed 0.33 pound of liquid for 1-pound water capacity of the can and the total weight of liquid in each can must not exceed 41 ounces. Each can must be tested for leakage after being filled and again after being maintained at ordinary room temperature for a period of at least three weeks. Each can must have its outer surface protected against rust by the use of enamel or lacquer. Not more than twelve cans shall be packed in the outside fibreboard box and each can shall be separated from the other by 200-pound minimum test fibreboard partitions. Each box shall be provided with 200-pound minimum test fibreboard liner and top and bottom pads of the same material. In addition to the required closure of the boxes, two metal straps measuring 1/2 inch by .015 inch must be applied around the girth of each box.

(d) Spec. 105A500-W or 105A600-W. Tank cars. Tank must be restencilled 105A300-W and be equipped with safety valves of the type and size used on spec. 105A300-W tank car. Tank car tank must be equipped with approved dome fittings and safety devices, and with cork insulation at least 4 inches in thickness. Written procedure covering details of tank car appurtenances, dome fittings and safety devices, and marking, loading, handling, inspection, and testing practices shall be filed with and approved by the Director of Operation, R.T.C. before any tank car is offered for transportation of hydrocyanic acid. The maximum permitted filling density is 63 per cent of the water capacity of the tank.

§ 73.333 Phosgene or diphosgene. (a) Phosgene or diphosgene must be packed in specification containers as follows:

(1) As prescribed in § 73.328 filling density (see § 73.304(a)(2) Table, Note 1) must not exceed 125 per cent and a cylinder must not contain more than 150 pounds of phosgene.

(2) Spec. 106A500-X tanks. Authorized only for phosgene. Each tank must be equipped with gas-tight valve protection caps which must be approved by the Director of Operation, R.T.C. Tanks must not be equipped with safety devices of any type. Outage must be sufficient to prevent tanks from becoming liquid full at 130°F. Authorized only for transportation by rail freight.

(b) Each filled cylinder must be tested for leakage before shipment and must show absolutely no leakage; this test must consist in immersing the cylinder and valve, without the protection cap attached, in a bath of water at a temperature of approximately 150°F. for at least thirty minutes, during which time frequent examinations must be made to note any escape of gas. The valve of the cylinder must not be loosened after this test and before shipment.

§ 73.334 Hexaethyl tetraphospate, tetraethyl dithio pyrophosphate, tetraethyl pyrophosphate, or other poison organic phosphate mixtures, mixed with compressed gas. (a) Hexaethyl tetraphospate, tetraethyl dithio pyrophosphate, tetraethyl pyrophosphate, or other poison organic phosphate, may be mixed with a compressed gas which must be nonflammable. This mixture must not contain more than 20 percent by weight of organic phosphate and must be packaged as follows:

(1) Spec. 3A240, 3AA240, 3B240, 4A240, 4B240, 4BA240, or 4BW240 cylinders meeting the following requirements:

(i) Each cylinder may be charged with not more than 10 pounds of the mixture, to a maximum filling density of not more than 80 percent of the water capacity;

(ii) Each cylinder must be charged in compliance with § 73.301(e) and (f);

(iii) No cylinder may be equipped with an eduction tube or a fusible plug;

(iv) No cylinder may be equipped with any valve unless the valve is a type approved for this installation;

(v) Cylinders must be overpacked in a box so arranged to protect each valve or other closing device from damage. No more than four cylinders may be packed in a box except that in a wooden box, up to 12 cylinders may be so packed. Each box with its closing device protection must be sufficiently strong to protect all parts of each inside cylinder from deformation or breakage if the completed package were dropped six feet onto solid concrete, impacting at the weakest point.

(b) Cylinders must be packed in strong wooden boxes with valves or other closing devices protected from injury, with not more than twelve cylinders in one outside wooden box. A single-trip outside fibreboard box may be used when not more than four such cylinders are to be shipped in one outside container. Valves must be adequately protected. Box and valve protection must be of strength sufficient to protect all parts of inside containers and valves from deformation or breakage resulting from a drop of at least six feet onto a concrete floor, impacting at the weakest point.

§ 73.336 Nitrogen dioxide, liquid, nitrogen peroxide, liquid, and nitrogen tetroxide, liquid. (a) Nitrogen dioxide, liquid, nitrogen peroxide, liquid, and nitrogen tetroxide, liquid must be packed in specification containers as follows:

(1) As prescribed in § 73.328 of this part.

(2) Spec. 3A480 or 3AA480, or 3AL1800 or 25. Metal cylinders with valve removed; valve opening to be closed by means of a solid metal plug with tapered thread properly luted to prevent leakage; valve protection cap must be used and be at least 3/16 inch thick, gas-tight, with 3/16 inch faced seat for gasket and with United States standard form thread. Use of this container will be permitted until further order of the Commission.

(3) Spec. 106A500X or 110A500W tanks. Each tank must be equipped with gas tight valve protection caps. Tanks must not be equipped with safety devices of any type. Outage must be sufficient to prevent tanks from becoming liquid full at 130°F. (55°C). Spec. 110A500W tanks must be of stainless steel.

(4) Spec. 105A500-W. Tank cars. Authorized for nitrogen tetroxide only. Tanks must be lagged with not less than a four-inch thickness of cork. All valves and fittings shall be protected by a securely attached cover made of metal not subject to deterioration by the lading, and all valve openings, except the safety valve, shall be fitted with screw plugs or caps to prevent leakage in the event of valve failure. Safety valve must be equipped with an approved stainless steel or platinum frangible disc. Written procedure covering details of tank car appurtenances, dome fittings and safety devices, and marking, loading, handling, inspection, and testing practices shall be filed with and approved by the Commission before any tank car is offered for transportation of nitrogen tetroxide.

§ 73.337 Nitric oxide. (a) Nitric oxide must be packed in specification containers as follows:

(1) Spec. 3A, 3AA, 3AL1800, or 3E1800 cylinders designed and marked for a service pressure of 1800 pounds per square inch or higher, charged to a pressure of not more than 750 pounds per square inch at 70°F. Cylinders must be equipped with a valve of stainless steel and valve seat of material which will not be deteriorated by contact with nitric oxide or nitrogen dioxide. Containers or valves must not be equipped with safety devices of any type. Valve outlets must be sealed by a solid threaded cap or plug and an inert gasketing material.

(2) Spec. 3E1800 cylinders must be packed in strong wooden boxes of such design as to protect valves from injury or accidental functioning under condition incident to transportation. Each outside shipping container must be plainly marked "INSIDE CONTAINERS COMPLY WITH PRESCRIBED SPECIFICATIONS."

(3) Spec. 3A, 3AL, and 3AA cylinders must have their valves protected by metal caps securely attached to the cylinders and of sufficient strength to protect the valves from injury during transit, or by packing in strong wooden boxes of such design as to protect valves from injury or accidental functioning under conditions incident to transportation. Each outside shipping container must be plainly marked "INSIDE CONTAINERS COMPLY WITH PRESCRIBED SPECIFICATIONS."

§ 73.338 Nitrogen tetroxide-nitric oxide mixtures containing up to 33.2 per cent weight nitric oxide. (a) Nitrogen tetroxide-nitric oxide mixtures containing up to 33.2 per cent weight nitric oxide must be packed in specification containers as follows:

(1) As prescribed in § 73.328.

(2) Spec. 3A480 or 3AA480. Metal cylinders with valve removed; valve opening to be closed by means of a solid metal plug with tapered thread properly luted to prevent leakage; valve protection cap must be used and be at least 3/16 inch thick, gas-tight, with 3/16 inch faced seat for gasket and with United States standard form thread.

NOTE: Tanks complying with Spec. 106A500 or 106A500-X may be transported on trucks or semi-trailers in piggyback services, when securely chocked or clamped thereon to prevent shifting, and provided adequate facilities are present for handling tanks where transfer in transit is necessary.

(3) Spec. 106A500-X tanks. Each tank must be equipped with gas-tight valve protection caps which must be approved by the Commission. Tanks must not be equipped with safety devices of any type. Outage must be sufficient to prevent tanks from becoming liquid full at 130°F. Authorized only for transportation by rail freight.

(4) Spec. 105A500-W. Tank cars. Tanks must be lagged with not less than a four-inch thickness of cork. All valves and fittings shall be protected by a securely attached cover made of metal not subject to deterioration by the lading and all valve openings, except the safety valve, shall be fitted with screw plugs or caps to prevent leakage in the event of valve failure. Safety valve must be equipped with an approved stainless steel

or platinum frangible disc. Written procedure covering details of tank car appurtenances, dome fittings and safety devices, and marking, loading, handling, inspection, and testing practices shall be filed with and approved by the Commission before any tank car is offered for transportation of nitrogen tetroxide-nitric oxide mixtures.

§ 73.344 Packaging for poisonous liquids, Division 6.1 (a) Closing and cushioning. All containers must be tightly and securely closed. Inside containers must be cushioned as prescribed, or in any case when necessary to prevent breakage or leakage.

(b) Packagings may not be completely filled. Outage must be as follows:

(1) For packagings of 92 gallons or less, sufficient outage must be provided so that the packaging will not be liquid full at 130°F. (55°C).

(2) The proper vacant space (outage) in a tank car or other shipping container depends on the coefficient of expansion of the liquid and the maximum increase of temperature to which it will be subjected in transit. Outage must be calculated to the total capacity of the container.

(3) Liquid poison must not be loaded into domes of tank cars.

(4) In tank cars, outage must be calculated to percentage of the total capacity of the tank, i.e., shell and dome capacity combined. If the dome of the tank car does not provide sufficient outage, then vacant space must be left in the shell to make up the required outage.

(5) The outage for tank cars must not be less than 1 per cent.

§ 73.345 Exemptions for poisonous liquids. Division 6.1, Packaging Groups I and II. (a) Poisonous liquids, except those for which not exemptions are provided as indicated by the "No exemption" statement in § 72.5, or as provided for in § 73.359(c), in tightly closed inside containers, securely cushioned when necessary to prevent breakage and packed as follows, are exempt from specification packaging requirements.

(1) In glass or earthenware containers not over 1 quart capacity each, or in metal containers or polyethylene bottles not over 1 gallon capacity each, packed in strong outside steel or wooden boxes, barrels, or drums.

(2) In glass or earthenware containers not over 1 pint capacity each, or in metal or polyethylene containers not over 1 quart capacity each, packed in strong outside fibreboard boxes, or molded expanded polystyrene cases.

(b) Deleted.

§ 73.346 Poisonous liquids not specifically provided for. (a) Poisonous liquids, other than those for which special requirements are prescribed, must be packed in specification containers of a design and constructed of materials that will not react dangerously with or be decomposed by the chemical packed therein, as follows:

(1) Spec. 5, 5A, 5B, or 5C. metal barrels or drums, with openings not exceeding 2.3 inches in diameter.

(2) Spec. 17C or 17E. Metal drums (single-trip containers), with openings not exceeding 2.3 inches in diameter.

(3) Spec. 37B. Metal drums (single-trip containers), welded side seams, openings not over 2.3 inches in diameter capacity not over 8½ gallons.

(4) Spec. 37A or 37B. Metal drums (single-trip containers), with welded side seams, not over 5 gallons; authorized for pastes only.

(5) Spec. 34. Polyethylene drum. The shipper shall assure conformance with the requirements of § 73.24(e) of this part prior to first shipment.

(6) Spec. 11A or 11B. Wooden barrels or kegs with glass or earthenware inside containers, not over 1 gallon capacity each, or with metal inside containers not over 2 gallons capacity each.

(7) Spec. 12B. Fibreboard boxes with glass or earthenware inside containers not over 1 quart capacity each, or with metal inside containers not over 1 gallon capacity each. Packages containing glass or earthenware containers must not weigh over 65 pounds gross.

(8) Spec. 12D. Fibreboard boxes with inside container which must be glass or earthenware not over one gallon each; authorized for not more than 75 pounds gross weight; not to contain more than 4 such inside containers if their capacity is greater than 5 pints each. Use of this container will be permitted until further order of the Commission.

(9) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes with glass or earthenware inside containers not over 1 gallon capacity each, except that inside containers up to 3 gallons are authorized when only one is packed in each outside container; or with metal inside containers, not over 8½ gallons capacity each.

(10) spec. 103[1], 103W, 103A[1], 103ALW, 103AW, 103BW, 104[1], 104W, 105A100[1], 105A100W, 109A300ALW, 111A60ALW1, 111A60F1, 111A60W1, 111A60W2, 111A100F2, 111A100W4, 112A400W, 114A400W, or 115A60W6. Tank cars. Spec. 103BW tank cars must be rubber lined and are authorized only for arsenic acid as prescribed in § 73.348 of this part.

(11) Cylinders as prescribed for any compressed gas, except acetylene, are also authorized.

(13) Spec. 1A, or 1D. Glass carboys in wooden boxes or plywood drums.

(14) Spec. 12B. Fibreboard boxes with not more than one inside glass container of not over 1 gallon capacity, securely cushioned. Completed package, with glass container filled with water, when closed for shipment, must be capable of withstanding six four-foot drops onto solid concrete in the order bottom, four sides, and top without breakage.

(15) Spec. 21C. Fibre drums, with inside glass containers not over one gallon capacity each.

(16) Spec. 42B, 42C, or 42D. Aluminum drums.

(18) Spec. 15P or 22C. Glued plywood or wooden box, or plywood drum as prescribed by Subparagraph 2(a) Specification 22C, with inside spec. 2T polyethylene container.

(19) Spec. 37P. Steel drums, not over 5 gallons capacity, with polyethylene liner (nonreusable container). Drums exceeding 1-gallon capacity must be constructed of at least 24 gauge metal. Hole in steel drum body must be suitably plugged. Authorized only for materials that will not react with polyethylene and result in container failure.

(20) Spec. 6D or 37M. Cylindrical steel overpacks with inside spec. 2S or 2SL polyethylene container. Authorized only for materials that will not react with polyethylene and result in container failure.

(21) Spec. 12A. Fibreboard boxes with not more than one inside glass bottle not over 1-gallon capacity. Shipper must have

[1] Use of existing tank cars authorized, but new construction not authorized.

established that the completed package meets test requirements prescribed by paragraph 10 of Spec. 12A.

(22) Spec. 29. Mailing tubes, with polyethylene bottles not over 2 quarts capacity each.

(24) Spec. 12P. Fibreboard boxes with an inside spec. 2U polyethylene container of not over 5 gallon capacity or two inside spec. 2U polyethylene containers of not over 2½ gallon capacity each. Wire staples are not authorized for assembly or closure of boxes, except when polyethlene container is completely enclosed in inside boxes free of wire staples or other projections, that could cause failures.

(25) Spec. 16A. Wirebound wooden box (See paragraph 22 Specification 16A) with inside specification 2U polyethylene container. The polyethyelene container shall be separated from the wooden box by a complete corrugated fibreboard liner and top and bottom pads.

(26) Spec. 12B or 12A. Fibreboard boxes with inside polyethylene bottles having a minimum wall thickness of 0.015 inch and provided with screw-cap closures, not over one gallon capacity each. Except for polyethylene bottles having a minimum wall thickness exceeding 0.015 inch, each bottle shall be enclosed in a box constructed of at least 200-pound test (Mullen or Cady) corrugated fibreboard and not more than four such boxes shall be packed in one outside specification shipping container. When spec. 12A boxes are used, shipper must have established that completed package meets test requirements prescribed by para. 10 of specification 12A.

(27) Spec. 51. Portable tank.

§ 73.347 Aniline oil. (a) Aniline oil must be packed in specification containers as follows:

(1) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes with metal inside containers not over 8½ gallons capacity each or glass bottles not over 1 pound capacity each. Not more than 25 of these bottles shall be packed in any outside container.

NOTE 1: Until further order of the Commission, glass bottles not over 2 quarts capacity each and not more than six of these bottles packed in one outside container are authorized.

(2) Spec. 103, 103W, 103A, 103AW, 104W, 105A100W, 111A60F1, 111A60W1, 111A60W2, 111A100F2, 112A200W, 112A400F, or 114A340W. Tank cars.

(4) Spec. 5, 5A, or 5B. Metal barrels or drums. Net weight in 92 gallon drums must not exceed 915 pounds.

(5) Spec. 17C. Metal drums (single-trip).

(6) Spec. 17E. Metal drums (single-trip) not over 5 gallons capacity each.

(7) Spec. 12B. Fibreboard boxes with metal inside containers not over 1 gallon capacity each; not to contain more than 4 such inside containers if their capacity is greater than 5 pints each.

(8) Spec. 12A. Fibreboard boxes with inside glass bottles or metal containers not over 1 gallon capacity each. Not more than four inside containers having capacity of 1 gallon each, shall be packed in one outside container. Shipper must have established that completed package meets test requirements prescribed by paragraph 10 of Spec. 12A.

(b) Openings in metal barrels or drums must not exceed 2.3 inches in diameter.

(1) Gaskets not less than one-eight inch thick must be used at bung and filling holes. Gaskets must be made of hard fibre impregnated with glycerin, metal-covered cork, impregnated asbestos sheets, or metal-covered asbestos.

(c) Filled drums must be so placed that bungs will be subjected to hydrostatic head of oil contained therein for a period of not less than 12 hours.

(1) The exterior of filled drums must be carefully examined for evidence of aniline oil, any traces of which must be removed by washing off with water or, preferably, weak acetic acid. the space between rolling hoops immediately around the bung should be painted to aid in the detection of leaks at this point.

(d) All returnable drums must bear the following notice, "PREVENT DAMAGE TO FOODSTUFFS OR OTHER FREIGHT. DRAIN THIS DRUM THOROUGHLY. TIGHTEN BUNGS, WITH GASKET, SECURELY IN PLACE BEFORE RETURNING. USE NEW GASKETS WHEN NECESSARY. ANILINE OIL STAINS ON THE OUTSIDE OF DRUMS SHOULD BE WASHED OFF WITH WATER OR, PREFERABLY, WEAK ACETIC ACID," shellacked to head of drum near the consignee's name and address.

§ 73.348 Arsenic acid. (a) Arsenic acid must be packed in specification containers as follows:

(1) As prescribed in § 73.346 of this part. When shipped in metal barrels or drums, or tank cars, without lead lining, the arsenic acid must contain not over 0.05 per cent nitric acid.

(2) Spec. 1A or 1D. Glass carboys in boxes.

(3) Spec. 12A or 12B. Fibreboard boxes with spec. 2E inside polyethylene bottles made of high-density (Type III) polyethylene having minimum wall thickness of 0.015 inch with screw cap closures, not over 1-gallon capacity each. Spec. 12A fibreboard boxes may have not more than four inside polyethylene bottles which must be packed to provide a snug fit. Spec. 12B fibreboard boxes may not contain more than one inside polyethylene bottle and not more than four such boxes may be overpacked in a strong outside fibreboard box.

(4) Spec. 21P. Fibre drum overpack with inside spec. 2S, 2SL, or 2U polyethylene packaging of not over 25-gallon capacity.

(5) Spec. 34. Polyethylene drum. The shipper shall assure conformance with the requirements of § 73.24(e) of this part prior to first shipment.

§ 73.349 Carbolic acid (phenol) liquid. (a) Carbolic acid (phenol) liquid (liquid tar acid containing over 50 per cent benzophenol), must be packed in specification containers as follows:

(1) As prescribed in § 73. 346 of this part.

(2) Spec. 1A or 1D. Glass carboys in boxes.

(3) Spec. 12A. Fibreboard boxes with inside glass bottles not over 5 pints capacity each. Not more than 6 inside glass bottles of 5 pints capacity each shall be packed in one outside container. Shipper must have established that the completed package meets test requirements prescribed by para. 10 of Spec. 12A.

(4) Spec. 34. Polyethylene drum. The shipper shall assure conformance with the requirements of § 73.24(e) of this part prior to first shipment.

§ 73.350 Chemical ammunition. (a) Chemical ammunition consisting of projectiles, shells, bombs, grenades, and other containers filled with gases, liquids, or chemicals, Division 6.1 poisons, Packing Groups I or II, without ignition elements, bursting charges, detonating fuzes, or other explosive compo-

nents, must be packed for shipment in strong outside wooden or metal boxes.

(b) Chemical ammunition, when shipped as such, must not be equipped or packed with explosive or ignition elements.

§ 73.351 Hydrocyanic acid solutions. (a) Hydrocyanic acid solutions must be in glass bottles not over 1 pound capacity each for solutions of not over 5 per cent strength and not over 5 pints capacity each for solutions of not over 2 per cent strength and must be packed in specification containers as follows:

(1) Spec. 15A, 15B, 15C, 16A, or 19A. Wooden boxes.

(2) Spec. 11A or 11B. Wooden barrels or kegs.

(b) Completed package, with glass packaging filled with water, must be capable of withstanding six four-foot drops onto solid concrete in the following order: bottom, four sides, and top, without breakage.

§ 73.352 Sodium and potassium cyanide solutions, and other cyanide solutions. (a) Sodium and potassium cyanide solutions, and other cyanide solutions must be packed in specification containers as follows:

(1) Spec. 5, 5A, or 5B. Metal barrels or drums without galvanizing inside, with openings not exceeding 2.3 inches in diameter.

(2) Spec. 17E or 37B. Metal drums (single-trip), with welded side seams, with openings not exceeding 2.3 inches in diameter.

(3) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes with inside glass or earthenware containers not over 1 gallon capacity each, or inside metal containers not over 8½ gallons capacity each, and without galvanizing.

(4) Spec. 103[1], 103W, 103A[1], 103AW, 105A400W, 111A60F1, 111A60W1, 111A60W2, 111A100F2, 112A400W, or 114A400W. Tank cars.

(7) Spec. 6D. Cylindrical steel overpack with inside spec. 2S or 2SL polyethylene packaging.

(8) Spec. 34. Polyethylene drum. The shipper shall ensure conformance with the requirements of § 73.24(e) of this part prior to first shipment.

§ 73.353 Methyl bromide, liquid, methyl bromide and ethylene dibromide, liquid mixtures, and methyl bromide and chloropicrin, liquid mixtures. (a) Methyl bromide, liquid, methyl bromide and ethylene dibromide, liquid mixtures, and methyl bromide and chloropicrin, liquid mixtures, must be packed in specification containers as follows:

(1) Spec. 5A. Metal drums not exceeding 25 gallons capacity or metal drums of bilge type not exceeding 27½ gallons capacity and with openings not exceeding 2.3 inches in diameter. Use of these containers will be permitted until further order of the Commission.

(2) Spec. 15A, 15B, 15C, 16A, 19A, 19B or 12B. Wooden, wire-bound wooden, or fibreboard boxes, with inside metal cans containing not over 1 pound each, or inside metal cans with a minimum wall thickness of 0.007-inch containing not over 1¾ pounds each. The 1-pound can must be able to withstand an interior pressure of 130 psig without leakage or permanent distortion and pressure of contents must not exceed 130 psig at 130°F. (55°C). The 1¾ pound can must be able to withstand an interior pressure of 140 psig without leakage or permanent distortion and pressure of contents must not exceed 140 psig at 130°F. (55°C). Outage shall be such that the cans will not become liquid full at 130°F. Cans must be of tinplate or lined with suitable material and must have concave or pressure ends.

(3) Spec. 3A225, 3AA225, 3B225, 3E1800, 4A225, 4B225, 4BA225, or 4BW225. Metal cylinders. Valves and other closing devices must be protected to prevent damage in transit, by screw-on metal caps or by packing the cylinders in strong boxes or crates. Cylinders having a wall thickness of less than 0.08 inch must be packed in boxes or crates.

(4) Spec. 4D300 or 4DA500. Metal spheres must be equipped with approved safety devices and must be packed in strong boxes or crates.

(5) Spec. 105A100[1], 105A100-W or 111A100-W-4 tank cars. Outage must be sufficient to prevent tank cars from becoming liquid full at 105°F.

(6) Spec. 106A500-X tanks. Outage must be sufficient to prevent tanks from becoming liquid full at 130°F. Authorized only for transportation by rail freight.

(7) Spec. 12B. Fibreboard box with inside tinplated metal cans containing not more than 6 ounces net weight of product per can. Cans must be capable of withstanding a pressure of 75 pounds per square inch at 130°F without leakage or permanent distortion. Not more than 12 cans may be packed snugly in the outside fibreboard box and gross weight of completed package shall not exceed 30 pounds. Authorized only for methyl bromide and ethylene dibromide mixtures.

(8) Spec. 51. Steel portable tanks having a design pressure of not less than 250 p.s.i. and equipped with a spring-loaded safety relief device.

(b) (Cancelled).

(c) Outage must be sufficient to prevent cylinders or spheres from becoming entirely filled with liquid at 130°F. and when the vacant space (outage) is charged with nitrogen, carbon dioxide, or air the pressure in the cylinder or sphere at 130°F. must not exceed 5/4 the marked service pressure of the cylinder or sphere.

(d) Spec. 17C. Metal drums (single-trip) not over 5 gallons marked capacity each and having no opening exceeding 2.3 inches in diameter. Authorized only for mixtures of methyl bromide and ethylene dibromide, liquid containing not over 40 per cent by weight of methyl bromide.

§ 73.354 Motor fuel antiknock mixture or tetraethyl lead.(a) Motor fuel antiknock mixtures or tetraethyl lead must be packed in specification containers as follows:

(1) Spec. 15A or 19B. Wooden boxes with inside glass or earthenware containers of not over 1-pint capacity each, or metal cans, enclosed in hermetically sealed (soldered) strong metal cans.

(2) Spec. 5 or 5A. Metal barrels or drums, with opening not exceeding 2.3 inches in diameter.

(3) Cylinders as prescribed for any compressed gas, except acetylene.

(4) Spec. 105A300-W. Tank car. Tank car not authorized for tetraethyl lead. Openings in tank heads to facilitate application of nickel lining are authorized and must be closed in an approved manner.

(6) Spec. 51. Portable tanks having a minimum design pressure of 100 pounds per square inch. Authorized for motor fuel anti-knock compound only.

(7) Spec. 12B. Fibreboard boxes constructed of at least 375-pound test (Mullen or Cady) solid fibreboard with inside metal

[1] Use of existing tank cars authorized, but new construction not authorized.

cans enclosed in hermetically sealed (soldered) metal cans, not over 5 pounds capacity each. Each inside metal container must be enclosed in a taped, double-faced corrugated liner constructed of at least 200-pound test (Mullen or Cady) fibreboard and fitted with die-cut end caps constructed of at least 200-pound test (Mullen or Cady) double-walled corrugated fibreboard. Authorized gross weight not over 90 pounds.

(b) Outage must be sufficient to prevent any container from becoming entirely filled with liquid at 130°F.

(c) Steel tanks conforming to ASME specifications (including marking) which contain solid or semi-solid residual motor fuel anti-knock compound (including rust, scale, or other contaminants) may be shipped by rail freight. All openings must be closed with gasketed blank flanges or vapour-tight threaded closures. Each tank must be secured and braced to prevent movement under conditions normally incident to transportation.

§ 73.355 Phenyldichlorarsine. (a) Phenyldichlorarsine must be packed in specification containers as follows:

(1) Spec. 5A. Metal barrels or drums, made of not less than 12 gauge steel, and limited to 25 gallons capacity, with openings not exceeding 2.3 inches in diameter. Each metal barrel or drum must be tested, before each filling to 20-pound hydrostatic test.

§ 73.356 Thiophosgene. (a) Thiophosgene must be packed in specification containers as follows:

(1) Spec. 12B. Fibreboard boxes, with inside containers which must be tightly closed glass bottles not exceeding 1 pint capacity each, securely packed in absorbent incombustible cushioning material. Cushioning material must be capable of absorbing entire contents of the container.

(2) Spec. 15A, 15B, or 19B. Wooden boxes, with inside containers which must be tightly closed glass bottles not exceeding 1 quart capacity each, securely packed in absorbent incombustible cushioning material. Cushioning material must be capable of absorbing entire contents of container.

§ 73.357 Chloropicrin and chloropicrin mixtures n.o.s., containing no compressed gas and no poisonous liquids Division 6.1, Packing Group I. (a) Chloropicrin, when offered for transportation by rail freight, must be packed in specification containers as follows:

(1) Spec. 15A, 15B, 15C, 16A, or 19B. Wooden boxes with inside glass bottles or tubes in hermetically sealed metal can in corrugated fibreboard cartons, spec. 2C. Bottles must contain not over 1 pound of liquid each, must be filled to not over 95 per cent capacity, must be tightly and securely closed, and must be cushioned in cans with at least ½ inch of absorbent material. Cans must be made of metal at least 32 gauge United States standard. Total amount of liquid in outside box must not exceed 24 pounds.

(2) Spec. 12B. One-piece corrugated fibreboard boxes at least 200-pound test with inside glass bottles or tubes in hermetically sealed metal cans in individual unsealed one-piece corrugated fibreboard boxes, spec. 12B at least 200-pound test. Bottles must contain not over 1 pound of liquid each, must be filled to not over 95 per cent capacity, must be tightly and securely closed, and must be cushioned in cans with at least ½ inch of absorbent material. Cans must be made of metal at least 32 gauge United States standard. Total amount of liquid in outside box must not exceed 12 pounds.

(3) Spec. 12B. One-piece corrugated fibreboard boxes at least 200-pound test with not more than one inside glass bottle or tube in a hermetically sealed metal can. Bottles must contain not over 1 pound of liquid, must be filled to not over 95 per cent capacity, must be tightly and securely closed, and must be cushioned in cans with at least ½ inch of absorbent material. Cans must be made of metal at least 32 gauge United States standard.

(4) Spec. 34. Polyethylene drum. The shipper shall ensure conformance with the requirements of § 73.24(e) of this part prior to first shipment.

(b) Chlorpicrin and mixtures of chlorpicrin containing no compressed gas or poisonous liquid, Division 6.1, Packing Group I. Chlorpicrin and mixtures of chlorpicrin containing no compressed gas or poisonous liquid, Division 6.1, Packing Group I, in addition to containers prescribed in paragraph (a) of this section, when offered for transportation by carriers by rail freight, may be shipped in specification containers as follows:

(1) Spec. 3A, 3AA, 3B, 3C, 3D, 3E, 4A, 4B, 4BA, 4BW, or 4C. Metal cylinder. Valves or other closing devices must be protected by screw-on metal caps, or by packaging the cylinders in boxes or crates, to protect the valves from damage during transportation. A cylinder closed by means of a solid plug may have the closure protected by a metal collar. Cylinders having a wall thickness of less than 0.08 inch must be packaged in boxes or crates. Each cylinder having a water capacity over 275 pounds must have a minimum design pressure of 225 p.s.i.g., unless the specification requires a higher minimum design pressure.

NOTE 1: (Cancelled).

(2) Spec. 5A or 5B. Metal drums not exceeding 27½ gallon capacity with welded seams. Spec. 5B authorized only for chloropicrin mixtures containing not over 45 percent chloropicrin by weight. Removable head containers not authorized.

(3) Spec. 17C or 17E. Metal drums (single-trip) with openings not over 2.3 inches in diameter. Capacity not to exceed 25 gallons for spec. 17E. Authorized only for mixtures of chloropicrin and technical grade dichloropropene containing not more than 15 percent chloropicrin by weight.

(4) Spec. 106A500-X tanks. Valves must be protected by metal caps. Tanks must be not equipped with safety devices of any type. Outage must be sufficient to prevent tanks from becoming liquid full at 130°F. Authorized only for transportation by rail freight.

(5) Spec. 105A300-W, 105A400-W, or 105A500-W. Tank cars.

(c) Chloropicrin and mixtures of chloropicrin containing no compressed gas or poisonous liquid, Division 6.1, Packing Group I, when offered for transportation by rail express must be packed in specification containers as follows (also authorized for transportation by carriers by rail freight.):

(1) Spec. 15A, 15B, 15C, 16A, or 19B. Wooden boxes with inside glass bottles or tubes in hermetically sealed metal cans in corrugated fibreboard cartons, spec. 2C. Bottles must contain not over 1 pound of liquid each, must be filled to not over 95 per cent capacity, must be tightly and securely closed, and must be cushioned in cans with at least ½ inch of absorbent material. Cans must be made of metal at least 32 gauge United States standard. Total amount of liquid in outside box must not exceed 24 pounds.

(2) Spec. 15A, or 19B. Wooden boxes, metal strapped, with chloropicrin absorbed in an efficient absorbing material packed

in hermetically sealed metal cans not exceeding 1 quart capacity each.

(3) Spec. 12B. One-piece corrugated fibreboard boxes at least 200-pound test with inside glass bottles or tubes in hermetically sealed metal cans in individual unsealed one-piece corrugated fibreboard boxes, spec. 12B at least 200-pound test. Bottles must contain not over 1 pound of liquid each, must be filled to not over 95 per cent capacity, must be tightly and securely closed, and must be cushioned in cans with at least ½ inch of absorbent material. Cans must be made of metal at least 32 gauge United States standard. Total amount of liquid in outside box must not exceed 12 pounds.

(4) Spec. 12B. One-piece corrugated fibreboard boxes at least 200-pound test with not more than one inside glass bottle or tube in a hermetically sealed metal can. Bottles must contain not over 1 pound of liquid, must be filled to not over 95 per cent capacity, must be tightly and securely closed, and must be cushioned in cans with at least ½ inch of absorbent material. Cans must be made of metal at least 32 gauge United States standard.

§ 73.358 Hexaethyl tetraphosphate, methyl parathion, organic phosphate compound mixtures, parathion, tetraethyl dithio pyrophosphate, and tetraethyl pyrophosphate, liquid. (a)Hexaethyl tetraphosphate, methyl parathion, organic phosphate compound mixtures, parathion, tetraethyl dithio pyrophosphate, and tetraethyl pyrophosphate, liquid must be packed in specification containers as follows:

(1) Spec. 5, 5A, or 5B. Metal barrels or drums, with openings not exceeding 2.3 inches in diameter.

(2) Spec. 17C or 17E, metal drums (single-trip), with openings not exceeding 2.3 inches in diameter. Spec. 17E drums authorized for not over 5 gallons capacity each.

(3) Spec. 15A, 15B, or 19B. Wooden boxes, with metal inside containers of not over 5 gallons capacity each.

(4) Spec. 12B. Fibreboard boxes, with inside glass bottles not over 1 gallon capacity each, securely cushioned in liquid-tight metal cans.

(5) Spec. 21C. Fibre drums, with inside glass containers not over one gallon capacity each.

(6) Spec. 37A. Metal drums (single-trip), with inside glass containers not over 1 gallon capacity each.

(7) Cylinders as prescribed for any compressed gas, except acetylene, are also authorized. CTC 3AL cylinders are authorized only for parathion and methyl parathion service.

(8) Spec. 12B. Fibreboard boxes with not more than one inside glass container of not over 1 gallon capacity, securely cushioned. Completed package, with glass container filled with water, when closed for shipment, must be capable of withstanding six four-foot drops onto solid concrete in the order bottom, four sides, and top without breakage.

(9) Spec. 12B. Fibreboard boxes with not more than one inside container of polyethylene, or other nonfragile plastic material, and closed by a screw cap of similar material, not over 1 pint, surrounded by absorbent cushioning and packed in a one gallon securely closed metal can which shall be surrounded with absorbent cushioning material within the outside fibreboard box.

(10) Spec. 42B. Aluminum drums.

(11) Spec. 105A200ALW or 105A300AW. Tank cars. Authorized for parathion, methyl parathion, and liquid organic phophate compounds only. The nominal water capacity of a tank car must not exceed 10,000 gallons.

(12) Spec 6D. Cylindrical steel overpack with an inside Spec. 2S polyethylene container. Each full removeable head overpack over 5 gallons capacity must be closed by means of a 12-gauge steel bolted ring closure with drop forged lugs, one of which is appropriately threaded. For an overpack not over 25 gallons capacity, the threaded lug must have at least a ⅜-inch bolt and locking nut, and for an overpack over 25 gallons capacity the bolt and locking nut must be at least ⅝-inch. Authorized only for materials that will not react with polyethlene and result in container failure.

§ 73.359 Hexaethyl tetraphosphate mixtures, methyl parathion mixtures, organic phosphate compound mixtures, parathion mixtures, tetraethyl dithio pyrophosphate mixtures, and tetraethyl pyrophosphate mixtures, liquid. (a)Hexaethyl tetraphosphate mixtures, methyl parathion mixtures, organic phosphate compound mixtures, parathion mixtures, tetraethyl dithio pyrophosphate mixtures, and tetraethyl pyrophosphate mixtures (solutions, emulsions, or emulsifiable liquids) containing not more than 50 per cent hexaethyl tetraphosphate, methyl parathion, organic phosphate compound mixtures, parathion, tetraethyl dithio pyrophosphate, or tetraethyl pyrophosphate by weight, must be packed in specification containers as follows:

(1) Spec. 5, 5A, or 5B. Metal barrels or drums, with opening not exceeding 2.3 inches in diameter.

(2) Spec. 17C. Metal drums (single-trip), with openings not exceeding 2.3 inches in diameter.

(3) Spec. 17E or 37B. Metal drums (single-trip), with openings not exceeding 2.3 inches in diameter. Capacity not to exceed 8½ gallons for spec. 17E drums. Spec. 37B drums must be constructed of at least 24-gauge metal with welded side seams, of capacity not over 5 gallons, and must be tested as prescribed by paras. 12 and 13 of Spec. 17E. Authorized only for mixtures not classed as flammable under these regulations.

(4) Spec. 15A, 15B, 15C, 15E, or 19B. Wooden boxes with metal inside containers not over 8½ gallons capacity each.

(5) Spec. 12B. Fibreboard boxes, with inside glass bottles not over 1 gallon capacity each, securely cushioned in liquid-tight metal cans.

(6) Spec. 21C. Fibre drums, with inside glass containers not over one gallon capacity each.

(7) Spec. 37A. Metal drums (single-trip, with inside glass containers not over 1 gallon capacity each.

(8) Spec. 12B. Fibreboard boxes as authorized by paragraph 19(a), spec. 12B.

(9) Spec. 12B. Fibreboard boxes with not more than one inside glass container of not over 1 gallon capacity, securely cushioned. Completed package, with glass container filled with water, when closed for shipment, must be capable of withstanding six four-foot drops onto solid concrete in the order bottom, four sides, and top without breakage.

(10) Spec. 42B. Aluminum drums.

(11) Spec. 12B. Fibreboard boxes with inside high-density polyethylene bottles not over 1-gallon capacity each. Polyethylene bottles must have a minimum wall thickness of 0.015 inch and be equipped with screw-cap closures additionally taped for securement. Each polyethylene bottle shall be packed in an inside fibreboard box. Not more than four inside fibreboard boxes

with inside polyethylene bottles shall be packed in one outside shipping container. Polyethylene used in construction of inside polyethylene bottles must be of a type compatible with the lading and shall prevent permeation of contents to a degree that would cause a hazardous condition in transportation and handling.

(12) Spec. 12A. Fibreboard boxes with inside securely closed metal containers not over 1 gallon capacity each. Fibreboard boxes shall be constructed of not less than 500-pound test (Mullen or Cady) double-wall corrugated fibreboard. Not more than six 1 gallon metal containers shall be packed in one outside container. Authorized gross weight not over 65 pounds.

(13) Spec. 105A300-W. Tank cars. Authorized for organic phosphate compounds mixtures, only.

(14) Spec. 6D. Cylindrical steel overpack with an inside Spec. 2S polyethylene container. Each full removable head overpack over 5 gallons capacity must be closed by means of a 12-gauge steel bolted ring closure with drop forged lugs, one of which is appropriately threaded. For an overpack not over 25 gallons capacity, the threaded lug must have at least a 3/8-inch bolt and locking nut, and for an overpack over 25 gallons capacity the bolt and locking nut must be at least 5/8-inch. Authorized only for materials that will not react with polyethylene and result in container failure.

(17) Spec. 37D. Nonreusable steel drum which must be made of not less than 21-gauge body and 20-gauge heads. Authorized only for methyl parathion mixtures, parathion mixtures, and organic phosphate compound mixtures, not exceeding a weight of 12 pounds per gallon.

(b) Hexaethyl tetraphosphate mixtures, methyl parathion mixtures, organic phosphate compound mixtures, parathion mixtures, tetraethyl dithio pyrophosphate mixtures, and tetraethyl pyrophosphate mixtures (solutions, emulsions, or emulsifiable liquids) containing more than 50 per cent hexaethyl tetraphosphate, methyl parathion, organic phosphate compound mixtures, parathion, tetraethyl dithio pyrophosphate, or tetraethyl pyrophosphate by weight, must be packed in specification containers as follows:

(1) Spec. 5, 5A, or 5B. Metal barrels or drums, with openings not exceeding 2.3 inches in diameter.

(2) Spec. 17C, 17E, or 37B. Metal drums (single-trip) with openings not exceeding 2.7 inches in diameter. Spec. 17E drums authorized for not over 5 gallons capacity each. Spec. 37B drums must be constructed of at least 24-gauge metal with welded side seam, of not over 5 gallons capacity, and must be tested as prescribed by paras. 12 and 13 of Spec. 17E.

(3) Spec. 15A, 15B, or 19B. Wooden boxes, with metal inside containers not over 5 gallons capacity each.

(4) Spec. 12B. Fibreboard boxes, with inside glass bottles not over 1 gallon capacity each, securely cushioned in liquid-tight metal cans.

(5) Spec. 21C. Fibre drums, with inside glass containers not over one gallon capacity each.

(6) Spec. 37A. Metal drums (single-trip), with inside glass containers not over 1 gallon capacity each.

(7) Spec. 12B. Fibreboard boxes with not more than one inside glass container of not over 1 gallon capacity securely cushioned. Completed package, with glass container filled with water, when closed for shipment, must be capable of withstanding six four-foot drops onto solid concrete in the order bottom, four sides, and top without breakage.

(8) Spec. 42B. Aluminum drums.

(9) Spec. 12B. Fibreboard boxes with not more than six inside high-density polyethylene bottles having screw-cap closures, not over 1 quart capacity each. Fibreboard boxes must have full-height corrugated fibreboard liner, top and bottom pads, and bottles must be separated by corrugated fibreboard partitions. Plastic used in construction of bottles must be of a type compatible with the lading.

(10) Spec. 6D. Cylindrical steel overpack with an inside Spec. 2S polyethylene container. Each full removable head overpack over 5 gallons capacity must be closed by means of a 12-gauge steel bolted ring closure with drop forged lugs, one of which is appropriately threaded. For an overpack not over 25 gallons capacity, the threaded lug must have at least a 3/8-inch bolt and locking nut, and for an overpack over 25 gallons capacity the bolt and locking nut must be at least 5/8-inch. Authorized only for materials that will not react with polyethylene and result in container failure.

(11) Spec. 12B30. Fibreboard boxes of not less than 275-pound test double wall corrugated with a 5-mil one piece polyethylene bag form-fitted to the inner wall. Authorized only for pressure sealed polyethylene capsules containing not over 3 milliliters each.

(12) Spec. 37D. Nonreusable steel drum which must be made of not less than 21-gauge body and 20-gauge heads. Authorized only for methyl parathion mixtures, parathion mixtures, and organic phosphate compound mixtures, not exceeding a weight of 12 pounds per gallon.

(c) Hexaethyl tetraphosphate mixtures, methyl parathion mixtures, organic phosphate compound mixtures, parathion mixtures, tetraethyl dithio pyrophosphate mixtures, and tetraethyl pyrophosphate mixtures (solutions, emulsions, or emulsifiable liquids) containing not more than 25 per cent hexaethyl tetraphosphate, methyl parathion, organic phosphate compound mixtures, parathion, tetraethyl dithio pyrophosphate, or tetraethyl pyrophosphate by weight, in inside metal containers not over 8 fluid ounces capacity each, packed in strong outside containers together with sufficient absorbent material to completely absorb the liquid in the event of leakage, are exempt from specification packaging requirements.

§ 73.360 Perchloro — methyl — mercaptan. (a) Perchloromethyl-mercaptan in any quantity must not be packed with any other article. When offered for transportation by carriers by rail freight, must be packed in specification containers as follows:

(1) Spec. 11A or 11B. Wooden barrels or kegs, with inside containers which must be glass bottles not over 2 quarts capacity each, individually enclosed in tightly closed metal cans and cushioned therein with incombustible material. Net weight not over 100 pounds in one outside container.

(2) Spec. 15A, 15B, 15C, 16A, or 19B. Wooden boxes, with inside containers which must be glass bottles not over 2 quarts capacity each, individually enclosed in tightly closed metal cans and cushioned therein with incombustible material. Net weight not over 100 pounds in one outside container.

(4) Spec. 5K or 5M. Nickel or monel barrels or drums.

(5) Spec. 51. Portable tanks, monel-clad. Tanks with bottom discharge outlets are prohibited.

§ 73.361 Aldrin mixtures, liquid, with more than 60 per

cent aldrin. (a) Aldrin mixtures, liquid, with more than 60 per cent aldrin must be shipped in specification containers as follows:

(1) As prescribed in § 73.346.

(2) Spec. 6B, or 6C. Metal barrels or drums. Authorized only for viscous mixtures or those which may become partially solid.

(3) Spec. 17C or 17H. Metal drums (single-trip). Drums with opening exceeding 2.3 inches in diameter authorized only for viscous mixtures or those which may become partially solid.

§ 73.362 4-Chloro-o-toluidine hydrochloride. (a) 4-Chloro-o-toluidine hydrochloride must be shipped in specification containers as follows:

(1) Spec. 12B. Fibreboard boxes with glass, polyethylene, or equally efficient inside containers not over 1 quart capacity each, securely packed in a tightly closed metal container.

(2) Spec. 15A, 15B, or 19B. Wooden boxes with glass, polyethylene, or equally efficient inside containers not over 1 quart capacity each. Glass containers must be securely packed in tightly closed metal containers.

(3) Spec. 17C or 17H. Metal drums (single-trip).

(4) Spec. 6B, or 6C. Metal barrels or drums.

§ 73.362a Dinitrophenol solutions. (a) Dinitrophenol solution must be packed in specification containers as follows:

(1) In containers prescribed in § 73.346.

(2) Spec. 12B. Fibreboard boxes with glass, earthenware, or metal inside containers not over 1 gallon capacity each; not to contain more than 4 inside glass or earthenware containers if their capacity is greater than 5 pints each.

§ 73.363 Packaging for poisonous solids, division 6.1 (a) Closing and cushioning. All containers must be tightly and securely closed. Inside containers must be cushioned as prescribed, or in any case when necessary to prevent breakage or leakage.

(b) Testing inside containers. All inside containers, except those made of glass, must be able to pass a test by dropping, after filling, from a height of 4 feet to solid concrete without rupture or sifting of contents, except that for bags with contents weighing 25 pounds, a drop test of 2 feet is required.

§ 73.364 Exemptions for poisonous solids, Division 6.1, Packing Groups I and II. (a) Unless excluded by paragraph (b) of this section, poisonous solids, Division 6.1, Packing Groups I and II, are exempted from specification packaging requirements if in tightly closed inside packaging securely cushioned when necessary to prevent breakage according to the following paragraphs.

(1) In inside glass, earthenware, or composition bottles or jars, or metal containers, or lock-corner sliding-lid wooden boxes, of not over 5 pounds capacity each; or chipboard, pasteboard, or fibre cartons, can, boxes, or tightly closed strong plastic bags or bottles compatible with product of not over 1 pound capacity each, packed in outside wooden or fibreboard boxes, or wooden barrels or kegs. Net weight of contents of outside container not over 100 pounds.

(2) In inside plastic bottles or jars, chipboard, pasteboard or fibre cartons, cans, or boxes, of not over 5 pounds capacity each, packed in outside fibreboard or wooden boxes. Not more than 6 of these cartons shall be packed in any outside container.

(b) The following materials are not exempted by this section: Cyanides (other than as specified in § 73.370 (b) and (d), hexaethyl tetraphosphate mixtures, methyl parathion mixtures, organic phosphorus compound mixtures, and materials for which § 72.5 provides "No exemption."

§ 73.365 Poisonous solids not specifically provided for. (a) Poisonous solids, other than those for which special requirements are prescribed, must be packed in specification containers of a design and constructed of material that will not react dangerously with or be decomposed by the chemical packed therein, as follows:

(1) Spec. 5, 5A, 5B, 6B, or 6C. Metal barrels or drums.

(2) Spec. 17E, 17H, 37A, or 37B. Metal drums (single-trip). Gross weight may not exceed 460 pounds. Regardless of the gross weight marking embossed on the drum, a drum constructed of 22-gauge steel is authorized for material fused solid in the drum with a gross weight not to exceed 880 pounds and for waste material containing arsenic trioxide with a gross weight not to exceed 550 pounds.

(3) Spec. 44D. Multiwall paper bags. Where extensible kraft is used, the minimum total basis weight must be 260 pounds and the outer wall may be no less than 60 pounds basis weight. Bag must have a metal foil inner liner. Net weight not over 50 pounds each. Authorized only for carbamate pesticide mixtures containing not more than 15 percent active ingredient.

(4) Spec. 12B. Fibreboard boxes, with inside wide-mouth, high-density polyethylene jars of 2½-pound capacity with a minimum wall thickness of 0.020 inch, or of 3-pound capacity with a minimum wall thickness of 0.035 inch. Each jar must have a screw-cap closure and not more than six jars are authorized per box. Completed package must meet test requirements of paragraph 10 of spec. 12A.

(5) Spec. 11A. Wooden barrels or kegs, tongued and grooved, net weight of contents not over 115 pounds each.

(6) Spec.12B or 12C. Fibreboard boxes, with inside containers which must be metal cans not over 25 pounds capacity each; glass bottles not over 1 gallon capacity each; fibre cans or boxes, spec. 2G; sliding-top wooden boxes, lined to prevent sifting, not over 25 pounds capacity each; or paper bags, spec. 2D. Packages containing glass or earthenware containers must not weigh over 65 pounds gross nor contain more than 4 inside containers of over 5 pints capacity each. Outside containers must be not over 5,000 cubic inches capacity nor contain over 50 pounds net weight each, except as provided in paragraph 23, spec. 12B.

TEST: The completed package prepared as for shipping must be capable of standing a drop of 4 feet to solid concrete without breakage of the container or any sifting of contents.

(7) Spec. 12B. Fibreboard boxes with securely closed inside fibreboard or chipboard boxes not over 6 pounds net weight each., Interior containers must be at least .028 inches thick for those not over 2½ pounds net weight each and at least .034 inches thick for others. Outside packages must contain not over 36 pounds net weight of material each.

TEST: The individual interior containers as well as the completed package prepared as for shipping must be capable of standing a drop of 4 feet to solid concrete without breakage of the container or any sifting of contents

(8) Spec. 15A, or 19B. Wooden boxes, with inside containers which must be securely closed paper bags, placed within a waterproof duplex bag, spec. 2J. Net weight of material in one outside box, not over 100 pounds.

(9) Spec. 15A, 15B, 15C, 16A, 19A, or 19B. Wooden boxes, with inside containers which must be metal cans not over 25

pounds capacity each; glass or earthenware containers not over 1 gallon capacity each; except that inside containers of not over 5 gallons each and containing not over 25 pounds net weight are authorized when only one inside container is packed in each outside container. Fibre cans or boxes, spec. 2G, or sliding-top wooden boxes, lined to prevent sifting, not over 25 pounds capacity each. Net weight of material in outside container, not over 100 pounds each.

(10) Spec. 18B. Wooden kits lined as prescribed by spec. 2K. Net weight not over 30 pounds each.

NOTE 1: Until further order of the Commission, use is permitted of spec. 21A fibre drums that will withstand two drops from height of 4 feet in same spot or one 6-foot drop, in place of drop test as provided in specification 21A. Maximum loaded capacity 225 pounds net.

(12) Spec. 22A. Plywood drums. Net weight not over 115 pounds each.

(13) Spec. 103[1], 103-W, 103A[1], 103A-W, 111A60-F-1, 111A60-W-1, 111A100-F-2, or 111A60W2. Tank cars.

(14) Spec. 21C. Fibre drums. Authorized net weight not over 225 pounds, except that a 21C400 drum may have a net weight not exceeding 350 pounds.

(15) Spec. 12B. Fibreboard boxes constructed of at least 275-pound test double-faced fibreboard and provided with a perimeter liner and bottom pad of at least 200-pound test fibreboard. Boxes constructed of at least 350-pound fibreboard having top and bottom pads shall not require perimeter liner. Product must be contained within a tightly closed polyethylene or other equally efficient plastic bag constructed of material having minimum thickness of 0.004 inch. Not more than 25 pounds net weight of product may be packed in one outside box.

(16) Spec. 12A. Fibreboard boxes with inside glass bottles not over 5 pounds capacity each. Not more than 4 inside glass bottles of 5 pounds capacity each shall be packed in one outside container. Shipper must have established that the completed package meets test requirements prescribed by para. 10 of Spec. 12A.

(17) Spec. 37P. Steel drums with polyethylene liner (nonreusable container), not over 12½-gallons capacity.

§ 73.366 Arsenic (arsenic trioxide) or arsenic acid (solid). (a) Arsenic (arsenic trioxide) or arsenic acid (solid) must be packed in specification containers as follows:

(1) As prescribed in § 73.365 of this part.

(3) In addition to specification containers prescribed in this section, arsenic (arsenic trioxide) or arsenic acid (solid) may be shipped when packed in portable, collapsible, rubber containers, not over 70 cubic feet capacity, of a type approved by the Commission. Authorized for carload shipments only.

(b) Import shipments of arsenic (arsenic trioxide) may also be shipped when packed as follows:

(1) Enclosed in strong waterproofed cloth containers, securely sewn and closed so as to provide a sift-proof package, and then packed in strong, tight, metal-strapped wooden boxes constructed of material not less than three-fourth inch thick throughout.

(2) In strong and tight metal drums enclosed in a strong outside wooden barrel.

(3) In tight metal drums of not over 20-gallon capacity and a maximum gross weight of 460 pounds. Drums must be constructed of at least 22-gauge steel.

§ 73.367 Arsenic compounds, n.o.s., lead arsenates, calcium arsenate, copper acetoarsenite, and arsenic metallic. (a) Arsenic compounds, n.o.s., lead arsenates, calcium arsenate, copper acetoarsenite, and arsenic metallic shall be packed in containers which meet one of the following specifications:

(1) As prescribed in § 73.365 of this part.

NOTE 1: Until further order of the Commission, wooden hoops as specified in paragraph 6. Spec. 11A may be used in lieu of steel hoops required by specification 10B.

(2) Spec. 36A or 36B. Triplex bags. Authorized only for arsenical insecticides and fungicides containing 10.0 per cent or less or arsenic trioxide.

(3) Spec. 44B. Multiwall paper bags with inside paper bags, spec. 2D. Net weight not over 50 pounds each.

(4) Spec. 44C. Multiwall paper bags. For carload shipments only. Net weight not over 50 pounds each.

(5) Spec. 44D. Multiwall paper bags. Where extensible kraft is used the minimum total basis weight shall be 260 pounds and the outer wall may be not less than 60 pounds basis weight. Net weight not over 50 pounds each.

(6) Spec. 44E. Multiwall paper bags constructed with minimum total basis weight of 160 pounds. For carload shipments only; loaded by the consignor and unloaded by the consignee or his duly authorized agent. Net weight not over 50 pounds each. Where extensible kraft is used the minimum total basis weight for 40 pounds net weight bags shall be 190 pounds and for 20 pounds net weight bags it shall be 150 pounds. Multiwall bags so constructed are authorized for less-than-carload as well as carload shipments.

(b) Arsenical compounds n.o.s. containing not more than 6 per cent arsenic of which not more than 0.5 per cent is water soluble must be packed in specification containers as follows:

(1) As prescribed in paragraph (a), (1) (2) or (3) of this section.

(2) Spec. 44B. Paper bags with two added inside thicknesses of No. 1 Kraft paper, one sheet having a Mullen test of 50 and the other sheet having a Mullen test of 40. Net weight not over 50 pounds each.

§ 73.368 Arsenical dust, arsenical flue dust, and other poisonous noncombustible by-product dusts; also arsenic trioxide, calcium arsenate, and sodium arsenate. (a) Arsenical dust, arsenical flue dust, and other poisonous noncombustible by-product dusts from metal recovery operations not subject to dangerous spontaneous heating, and arsenic trioxide, calcium arsenate, or sodium arsenate, when delivery is made to plants with private sidings only may, in addition to packagings prescribed in § 73.367, be shipped in bulk in the following kinds of cars, if those cars are assigned exclusively to this type of service: (1) Sift-proof, self-clearing, hopper or bottom outlet steel cars, (2) sift-proof all steel flat bottom gondola cars with fixed sides and ends equipped with waterproof and dustproof wooden or steel covers well secured in place for all openings, and (3) sift-proof box cars of all steel construction. Cars assigned exclusively to this service must be marked "ARSENICAL SERVICE ONLY", in addition to other required markings, and are not subject to § 74.566(b) while in that service.

§ 73.369 Carbolic acid (phenol), not liquid. (a) Carbolic acid (phenol), not liquid, must be packed in specification containers as follows:

(1) Spec. 5, 5A, 5B, 5C, 6B or 6C. Metal barrels or drums.

(2) Spec. 11A or 11B. Wooden barrels of kegs with securely

[1] Use of existing tank cars authorized, but new construction not authorized.

closed inside drums of metal not thinner than No. 26 gauge, the space between drum and barrel or keg being filled with sawdust or rice hulls.

(3) Spec. 11A or 11B. Wooden barrels or kegs with glass or earthenware inside containers, not over 1 gallon capacity each, or with metal inside containers not over 2 gallons capacity each.

(4) Spec. 12B. Fibreboard boxes with inside containers which must be metal cans not over 25 pounds capacity each.

(5) Spec. 12B. Fibreboard boxes with glass or earthenware inside containers not over 1 quart capacity each, or with metal inside containers not over 1 gallon capacity each. Packages containing glass or earthenware containers must not weigh over 65 pounds gross; packages containing metal cans not over 84 pounds gross as provided in paragraph 23, spec. 12B, 65 pounds for others.

(6) Spec. 12D. Fibreboard boxes with inside containers which must be: Glass or earthenware not over 1 gallon or 5 pounds capacity each; authorized for not more than 75 pounds gross weight; not to contain more than 4 such inside containers if their capacity is greater than 5 pints each.

(7) Spec. 15A, 15B, 15C, 16A, 19A or 19B. Wooden boxes with glass or earthenware inside containers not over 1 gallon or 5 pounds capacity each, except that inside containers up to 3 gallons or 15 pounds capacity each are authorized when only 1 is packed in each outside container; or with metal inside containers not over 8½ gallons capacity each.

(8) Spec. 15A, 15B, 15C or 19B. Wooden boxes with metal inside containers, spec. 2F not over 250 pounds total capacity each.

(9) Spec. 17E or 17H. Metal drums (single-trip).

(11) Spec. 37A or 37B. Metal drums (single-trip).

(12) Spec. 42B or 42C. Aluminum drums.

(13) Spec. 103[1], 103W, 103ALW, 103A[1], 103AW, 103A-ALW, 111A60-ALW1, 111A60F1, 111A60W1, 111A60W2, 111A100F2, or 115A60W6. Tank cars.

(i) Tank cars must not be entirely filled. Sufficient interior space must be left vacant to prevent leakage from or distortion due to the contents liquefying and expanding from increase of temperature during transit.

(ii) Solid phenol must not be loaded into domes of tank cars.

(iii) In tank cars, outage must be calculated to percentage of the total capacity of the tank, i.e., shell and dome capacity combined. If the dome of the tank car does not provide sufficient outage, then vacant space must be left in the shell to make up the required outage.

(iv) the outage for tank cars must not be less than one per cent.

(15) Spec. 12A. Fibreboard boxes with inside glass, polyethylene, or other nonfragile plastic bottles not over 5 pounds capacity each. Not more than 4 inside glass bottles of 5 pounds capacity each shall be packed in one outside container. Shipper must have established that the complete package meets test requirements prescribed by para. 10 of Spec. 12A.

(16) Spec. 21C. Fibre drums with not more than one inside metal container, spec. 2A, having maximum net weight of 50 pounds.

(b) Carbolic acid (phenol), not liquid, in tightly closed inside containers, securely cushioned when necessary to prevent breakage and packed as follows, is exempt from specification packaging requirements.

(1) Inside glass, earthenware, polyethylene or other non fragile plastic bottles or jars not over 1 pound capacity each, or metal containers not over 5 pounds capacity each, packed in outside wooden boxes, barrels or kegs, or fibreboard boxes. Net weight of contents in fibreboard boxes shall not exceed 65 pounds; and not more than 100 pounds in wooden boxes, barrels or kegs.

§ 73.370 Cyanides and mixtures, dry. (a) Cyanides, or cyanide mixtures (see par. (b) of this section for exemptions) except cyanide of calcium and mixtures thereof (see par. (c) of this section for packaging requirements and par. (d) of this section for exemptions) if containing the cyanogen equivalent of 10 per cent or more of potassium cyanide, must be packed in specification containers as follows:

(1) Spec. 15A, 15B, 15C, or 19B. Wooden boxes with metal inside containers, spec. 2F, not over 25 pounds capacity each; or hermetically sealed (soldered) metal lining, spec. 2F, or in glass bottles not over 5 pounds capacity each.

(2) Spec. 11A or 11B. Wooden barrels with metal inside containers, spec. 2F not over 25 pounds capacity each; or hermetically sealed (soldered), metal lining, spec. 2F.

(3) Spec. 12B or 12C. Fibreboard boxes with metal inside containers, spec. 2F not over 25 pounds capacity each.

(4) Spec. 5, 5A, 5B, 6B, or 6C. Metal barrels or drums.

(5) Spec. 37A or 37B metal drums (single-trip containers).

(6) Bulk in watertight metal cars or in watertight container car metal containers.

(7) Spec. 17H. Metal drums. Gross weight not over 450 pounds.

(8) Spec. 45B. Bags, cloth, and paper, lined. Authorized only for sodium cyanides of globular or pellet form, diameter not less than ¾ inch. Net weight not over 100 pounds.

(9) Spec. 12B40. Fibreboard box with inside polyethylene bottles having a minimum thickness of 0.030 inch and not over 5 pound capacity each. Maximum net weight of contents must not exceed 25 pounds per box.

(11) Spec. 21C. Fibre drums. Authorized net weight not over 225 pounds.

(12) Spec. 12B. Fibreboard boxes constructed of at least 275-pound test double-faced fibreboard and provided with a perimeter liner and bottom pad of at least 200-pound test fibreboard. Boxes constructed of at least 350-pound fibreboard having top and bottom pads shall not require perimeter liner. Products must be contained within a tightly closed polyethylene or other equally efficient plastic container constructed of material having minimum thickness of 0.004 inch. Not more than 25 pounds net weight of product may be packed in one outside box.

(13) Bulk in strong, water-tight, metal portable containers of not over 70 cubic feet capacity each, approved by the Director of Operation, R.T.C.

(b) Cyanides, except cyanide of calcium and mixtures thereof; exemptions. Cyanides, except cyanide of calcium and mixtures thereof (see paragraph (d) of this section), when packed and described as follows are exempt from specification packaging requirements.

(1) Cyanides, or cyanide mixtures, in tightly closed glass

[1] Use of existing tank cars authorized, but new construction not authorized.

earthenware, metal, or polyethylene inside containers, not over 1 pound each, securely cushioned and packed in outside wooden or fibreboard boxes, or in wooden barrels. Net weight of cyanides or cyanide mixtures in any outside container, not over 25 pounds.

(2) Cyanide mixtures in tightly closed glass, earthenware, or metal inside containers, securely cushioned and packed in outside wooden or fibreboard boxes, or in wooden barrels. Net weight of cyanide mixtures in any outside container, not over 5 pounds.

(3) Cyanides of copper, zinc, lead and silver are exempted from all packaging requirements except those of §§ 73.24 and 73.363.

(c) Cyanide of calcium and mixtures thereof. Cyanide of calcium and mixtures thereof must be packed in specification containers as follows:

(1) As prescribed in paragraphs (a)(2), (3), (4), (6) or (11) of this section.

(2) Spec. 15A, 15B, 15C, or 19B. Wooden boxes with metal inside containers, spec. 2F, not over 25 pounds capacity each; or hermetically sealed (soldered) metal lining, spec. 2F.

(3) Spec. 37A or 37B metal drums (single-trip containers); welded side seams required for spec. 37B drums and all seams and closures must be watertight and hermetically sealed.

(d) Cyanide of calcium and mixtures thereof; exemptions Cyanide of calcium and mixtures thereof when packed and described as follows are exempt from specification packaging requirements.

(1) Cyanide of calcium and mixtures thereof in tightly closed metal inside containers having not over 1 pound net weight each, or metal cans having not over 5 pounds net weight each. Not more than 25-1 pound containers or more than 1-5 pound container securely cushioned may be packed in the outside container which must be wooden or fibreboard boxes, or wooden barrels.

§ 73.371 Dinitrobenzenes. (a) Dinitrobenzenes must be packed in specification containers as follows:

(1) As prescribed in § 73.346 or § 73.365.

(2) Spec. 11A. Wooden barrels, gross weight 300 pounds; must be shipped in carload shipments only and must not be offered for transportation by carriers by rail express.

§73.372 Mercury bichloride (mercuric chloride). (a) Mercury bichloride (mercuric chloride) must be packed in specification containers as follows:

(1) As prescribed in § 73.365 of this part.

(2) Spec. 15A or 19B. Wooden boxes with inside containers consisting of strong paper bags in tightly closed inside wooden boxes.

§ 73.373 Ortho-nitroaniline and paranitraniline. (a) Ortho-nitroaniline and paranitraniline must be packed in specification containers as follows:

(1) As prescribed in § 73.365 of this part.

(2) Spec. 11A. Wooden barrels, gross weight 385 pounds; must be shipped in carload shipment only, and must not be offered for transportation by carriers by rail express.

(3) Spec. 21C. Fibre drums. Authorized net weight not over 400 pounds.

(5) Spec. 56. Metal portable tank. Authorized for paranitroaniline only.

§ 73.374 Chloronitrobenzene, meta or para. (a) Chloronitrobenzene, meta or para, must be packed in specification containers as follows:

(1) As prescribed in § 73.365 of this part.

(2) Spec. 21C. Fibre drums, authorized only for chloronitrobenzene, para, flaked. Authorized net weight not over 400 pounds.

(3) Spec. 17E. Metal drums (single-trip).

(5) Spec. 105A400W, 112A400W or 114A400W. Tank cars.

§ 73.375 Sodium azide. (a) Sodium azide must be packed in specification containers as follows:

(1) Spec. 15A or 19B. Wooden boxes, with inside containers which must be securely closed paper bags, placed within a water-proof duplex bag, spec. 2J. Net weight of material in one outside box, not over 100 pounds.

NOTE 1: Until further order of the Commission, uncreped bags may be used.

(2) Spec. 21C. Fibre drums with inside polyethylene moisture barrier. Maximum net weight may not exceed 115 pounds.

(3) Spec. 56. Stainless steel portable tank designed for top loading and unloading only. Tanks may be equipped with a bottom clean out plug. No part of the tank or fittings that come in contact with the sodium azide may contain any metal such as copper, lead, silver or mercury which can form explosive azide compounds. Each car must be loaded by the consignor and unloaded by the consignee or by persons trained by the consignor.

§ 73.376 Aldrin and aldrin mixtures, dry, with more than 65 per cent aldrin. (a) Aldrin and aldrin mixtures, dry, with more than 65 per cent aldrin, must be packed in specification containers as follows:

(1) As prescribed in § 73.365.

§ 73.377 Hexaethyl tetraphosphate mixtures, methyl parathion mixtures, organic phosphate compound mixtures, parathion mixtures, tetraethyl dithio pyrophosphate mixtures, and tetraethyl pyrophosphate mixtures, dry. (a) Hexaethyl tetraphosphate mixtures, methyl parathion mixtures, organic phosphate compound mixtures, parathion mixtures, tetraethyl dithio pyrophosphate mixtures, and tetraethyl pyrophosphate mixtures in which the liquid is absorbed in concentrations greater than 2 per cent but not exceeding 27 per cent in an inert dry material so as to form a dry mixture, must be packed in specification containers as follows:

(1) Spec. 12B or 12C. Fibreboard boxes, with inside containers which must be metal or fibre cans not over 12 pounds capacity each, or paper bags, spec. 2D, not over 12 pounds capacity each. Fibreboard boxes manufactured and marked for a gross weight of 65 pounds may have a gross weight of 70 pounds provided net weight of contents does not exceed 62 pounds. Inside containers and the completed package must be capable of withstanding the tests prescribed in paragraphs (c), (d), and (e) of this section.

(2) Spec. 15A, 15B, or 19B. Wooden boxes with inside metal or fibre cans not over 12 pounds capacity each, or paper bags, spec. 2D not over 20½ pounds capacity each. Inside containers must be capable of withstanding the tests prescribed in paragraphs (c) and (d) of this section.

(3) Spec. 5, 5B, or 6C. Metal barrels or drums.

(4) Spec. 17C, 17H, or 37A. Metal drums (single-trip). Spec. 37A metal drums authorized for not over 100 pounds net weight.

(5) Spec. 21C. Fibre drums. Authorized net weight not over

250 pounds.

(b) Hexaethyl tetraphosphate mixtures, methyl parathion mixtures, organic phosphate compound mixtures, parathion mixtures, tetraethyl dithio pyrophosphate mixtures, and tetraethyl pyrophosphate mixtures in which the liquid is absorbed in concentrations greater than 27 per cent in an inert dry material so as to form a dry mixture, must be packed in specification containers as follows:

(1) Spec. 12B or 12C. Fibreboard boxes, with inside containers which must be metal cans not over 12 pounds capacity each. Inside containers and the completed package must be capable of withstanding the tests prescribed in paragraphs (c), and (e) of this section.

(2) Spec. 15A, 15B or 19B. Wooden boxes, with inside containers which must be metal cans not over 12 pounds capacity each. Inside containers must be capable of withstanding the tests prescribed in paragraph (c) of this section.

(3) Spec. 5, 5B, or 6C. Metal barrels or drums.

(4) Spec. 17C, 17H, or 37A. Metal drums (single-trip). Spec. 37A metal drums authorized for not over 100 pounds net weight.

(5) Spec. 21C. Fibre drums. Authorized only for mixtures in which the liquid is absorbed in concentration not greater than 50 per cent. Authorized net weight not over 225 pounds.

(6) Spec. 12B. Fibreboard box with inside spec. 2D paper bags not over 5-pound capacity each and having an additional foil liner. Completed package may not exceed 65 pounds gross weight and must meet the test requirements of paragraphs (d) and (e) of this section. Authorized only for mixtures in which the liquid is absorbed in concentrations no greater than 67 per cent.

(c) Inside metal or fibre cans when closed as for shipment must be capable of withstanding two four-foot drops onto solid concrete without breakage of the container or any sifting of the contents. One drop must be on side of can and the other diagonally on the top rim or chime.

(d) Inside paper bags when closed as for shipment must be capable of withstanding two four-foot drops onto solid concrete without breakage of the container or any sifting of the contents. One drop must be made on bottom of bag and the other on either large face.

(e) Completed packages when closed as for shipment must be capable of withstanding two four-foot drops onto solid concrete without breakage of the container or any sifting of the contents. One drop must be made on bottom of package and the other drop on the smallest adjacent side area.

(f) Dry mixtures containing not more than 2 per cent by weight of hexaethyl tetraphosphate, methyl parathion, organic phosphate compound mixtures, parathion, tetraethyl dithio pyrophosphate, or tetraethyl pyrophosphate and in which the liquid is absorbed in an inert material, are exempt from specification packaging requirements, for transportation by rail freight or rail express.

(g) Dry mixtures containing more than 2 per cent but not exceeding 15 per cent by weight of hexaethyl tetraphosphate, methyl parathion, organic phosphate compound mixtures, parathion, tetraethyl dithio pyrophosphate, or tetraethyl pyrophosphate, and in which the liquid is absorbed in an inert material, in addition to containers prescribed in paragraphs (a) and (b) of this section, may be packed in specification containers as follows:

(1) Spec. 44B. Multi-wall paper bags with inside paper bags, spec. 2D, not over 5 pounds capacity each. Net weight of material in outside container not over 30 pounds each.

(2) Spec. 12B. Fibreboard boxes constructed of at least 275-pound test double-faced fibreboard and provided with a perimeter liner and top and bottom pad of at least 275-pound test fibreboard. Product must be contained within a tightly closed polyethylene or other equally efficient plastic bag constructed of material having minimum thickness of 0.003 inch. Not more than 50 pounds net weight of product may be packed in one outside box.

(h) Dry mixtures containing more than 2 per cent but not exceeding 5 per cent by weight of hexaethyl tetraphosphate, methyl parathion, organic phosphate compound mixtures, parathion, tetraethyl dithio pyrophosphate, or tetraethyl pyrophosphate, and in which the liquid is absorbed in an inert material, in addition to containers prescribed in paragraphs (a), (b) and (g) of this section, may be packed in specification containers as follows:

(1) Spec. 44D. Multi-wall paper bags not over 50 pounds net weight each. Where extensible kraft is used the minimum, total basis weight shall be 260 pounds.

(i) Dry mixtures containing more than 2 per cent but not exceeding 12 per cent by weight of hexaethyl tetraphosphate, methyl parathion, organic phosphate compound mixtures, parathion, tetraethyl dithio pyrophosphate, or tetraethyl pyrophosphate, and in which the liquid is absorbed in an inert material, in addition to containers prescribed in paragraphs (a), (b) and (g) of this section, may be packed in specification containers as follows:

(1) Spec. 44D. Multiwall paper bags not over 50 pounds net weight each. Outer ply to be not less than 60 pounds basis weight.

(j) Dry mixtures containing more than 2 per cent but not exceeding 16.5 percent by weight of hexaethyl tetraphosphate, methyl parathion mixtures, organic phosphate compound mixtures, parathion, tetraethyl dithio pyrophosphate, or tetraethyl pyrophosphate, and in which the liquid is absorbed in an inert material, in addition to containers prescribed in paragraphs (a) and (b) of this section, may be packed in specification containers as follows:

(1) Spec. 44B. Multiwall paper bags having not more than 5 spec. 2D inner bags, each fabricated with a foil liner and containing not more than ten pounds net weight. Maximum net weight of material in each outside container may not exceed 50 pounds.

(2) Spec. 44D. Multiwall paper bags consisting of 6-ply extensible kraft paper having a minimum total basis weight of 320 pounds. Bags must have a metal foil inner liner and contain not over 60 pounds net weight.

(3) Spec. 44D. Multiwall paper bags consisting of 5-ply extensible kraft paper having a minimum total basis weight of 300 pounds. Bags may have outer sheet of 60 pound kraft in place of 70-pound basis weight but must have a metal foil inner liner. Maximum net weight may not exceed 54 pounds each.

§ 73.379 Cyanogen bromide. (a) Cyanogen bromide must be packed in tightly closed glass, earthenware, or metal inside containers not over 1-pound capacity each, securely cushioned and packed in outside wooden boxes. Net weight not over 25 pounds in one outside container.

§ 73.384 Chloroacetone, stabilized. (a) Chloroacetone, (b) stabilized, must be packed in specification containers as follows:

(1) Spec. 5, 5A, or 17C (single-trip). Metal barrels or drums.

(2) Spec. 15A, 15B, 15C, 16A, or 19B. Wooden boxes with inside glass bottles or tubes in metal cans hermetically sealed or with covers securely taped. The metal cans must be in corrugated fibreboard cartons, specification 2C. Bottles must not contain more than 1 pound of liquid each, must not be filled to more than 95 per cent capacity, must be tightly and securely closed, and must be cushioned in cans with at least one-half inch of absorbent material. Cans must be made of metal at least 32-gauge U.S. Standard. The total amount of liquid per package must not exceed 24 pounds.

§ 73.385 Tear gas grenades, tear gas candles, or similar devices. (a) Tear gas grenades, tear gas candles, or similar devices containing lachrymatory (tear producing) substances, for civil or military use must be packed in specification containers as follows (see § 73.101(d) and (e) of this part for packing tear gas cartridges):

(1) Spec. 15A, 15B, 15C, or 19B. Metal-strapped wooden boxes. Functioning elements not assembled in grenades or devices must be in a separate compartment of these boxes, or in inside or separate outside boxes, specification 15A, 15B, and must be so packed and cushioned that they may not come in contact with each other or with the walls of boxes during transportation. Not more than 50 grenades and 50 functioning devices shall be packed in one package and the gross weight of the package must not exceed 75 pounds.

(2) Spec. 37A. Metal drum (single-trip). Functioning elements must be packed in separate compartment. Not more than 24 grenades and 24 functioning devices shall be packed in one outside container and the gross weight of the container must not exceed 75 pounds.

(3) Spec. 12B. Fibreboard box with inside tear gas devices meeting specs. 2P or 2Q. Each inside container must be placed into spiral wound tubes fitted with metal ends or a double-faced fibreboard box with suitable padding. Not more than 30 inside containers shall be placed in one outside box and gross weight shall not exceed 35 pounds.

(b) These articles must not be assembled with or packed in the same compartment with mechanically or manually operated firing, igniting, bursting, or other functioning elements, unless of a type or design approved by the Director of Operation, R.T.C.

(c) No shipment of packages containing articles falling under this section may be made until samples of the articles have been approved for transport by rail by the Director of Operation, R.T.C.

NOTE 1: Grenades or other similar devices may be shipped completely assembled when shipments are made by, for, or to the Department of National Defence, provided the functioning element is so packed that it cannot accidentally function. The outside containers must be metal strapped wooden boxes, spec. 15A, 15B, 15C or 19B.

§73.386 Miscellaneous dangerous substances.

(c) All Class 9 commodities unless otherwise specified in Section 72.5 are exempt from the packaging requirements of these regulations.

(d) Asbestos: Asbestos must be offered for transportation and transported in:

(1) Rigid leaktight packagings, such as metal or fiber drums, portable tanks, or hopper-type rail cars;

(2) Bags or other non-rigid packaging in closed freight containers, or rail cars that are loaded by and for the exclusive use of the consignor and unloaded by the consignee;

(3) Bags or other non-rigid packagings which are dust and sift-proof. Such packagings containing asbestos must be palletized and unitized by methods such as shrink-wrapping in plastic film or wrapping in fiberboard secured by strapping; or

(4) Bags or other non-rigid packagings which are dust and sift-proof in strong outside fiberboard or wooden boxes.

§ 73.389 Packaging requirements for radioactive materials. (a) All radioactive materials shall be packaged in accordance with the requirements of the "Transport Packaging of Radioactive Materials Regulations" (SOR/83-740).

(b) Packages of radioactive materials approved by the Atomic Energy Control Board under sections 4, 15, and 16 of the above-mentioned regulations are not authorized for rail transport unless the authorization, certificate or endorsement issued by the Board for such packages is countersigned by the Director of Operation, R.T.C.

SUBPART I — EMERGENCY RESPONSE FORMS

73.429 Emergency Response Form, carloads. (a) Notwithstanding the provisions of Section 73.8, carload, trailerload and container-load shipments of dangerous commodities transported by rail in Canada except flammable liquid division 3.3, and class 9 commodities shall be accompanied by an Emergency Response Form which shall be furnished by the shipper to the carrier and shall accompany the car, trailer or container from the shipper's siding to the consignee's siding.

When a unit train shipment of a single dangerous commodity is made from one shipper at one point of origin to one consignee at one destination, one Emergency Response Form is sufficient to accompany such shipment provided a list of the car numbers is attached thereto.

In the case of compartmentized tank cars loaded with one or more dangerous commodities, except flammable liquids division 3.3 and class 9, a separate Emergency Response Form is required for each commodity and the location of the commodity in the car shall be indicated in the appropriate space provided on the form.

The setup of the Emergency Response Forms shall be as indicated at the end of this section and each form shall be printed on both sides on 216 mm wide by 280 mm high durable stock. Each form shall be printed both in English and French in the manner prescribed in the sample form. The area 6 mm from the edges of both sides of the forms shall be printed with alternate black and white oblique stripes.

The Emergency Response Form shall provide the following information:

1. The word "URGENT" in the center on top of both sides of the form in letters at least 9.5 mm high.
2. Commodity name (72.5) in letters at least 5 mm high.
3. Identification number (72.5) in letters at least 5 mm high.
4. Classification
5. Car, container, or trailer initials and number (eg. U.V.W.X. 1234).
6. Weight or volume (as appropriate)
7. Shipper's designated 24-hour emergency telephone number.

7. Shipper's designated 24-hour emergency telephone number.
8. The type of placard applied.
9. Shipper
10. Consignee (when available)
11. Date shipped
12. Shipping point
13. Destination (when available)
14. Routing (when available).

In addition, the Emergency Response Form shall include on its front side, Immediate Action Information[1] under the headings[2].

General
Spill or leak
Fire
First aid

The reverse side shall include general information pertaining to the commodity under "General Characteristics" and on its potential hazards[1] under the headings[2].

Fire
Explosion
Health

The minimal information to be included in the Emergency Response Form for any dangerous commodity shall be as shown in the applicable specimen Form in Appendix A to this subpart. The shipper may add any further information applicable to the commodity being shipped in the appropriate section of the form provided this information is not inconsistent therewith.

In the case of Dangerous Commodities for which no Emergency Response forms have been approved by the Railway Transport Committee, the shipper shall ask the Director of Operations for advice.

(b) The expressions "SPECIAL COMMODITY" and "MARCHANDISE SPECIALE" shall be shown at the top of the form, and at least one of these expressions shall be shown on the top right corner of the form.

(i) in letters not less than 8.2 mm high, or

(ii) in bold-face upper-case letters not less than 2.5 mm high highlighted so as to be conspicuous.

(c) In the event of an accident involving a train transporting dangerous commodities, a member of the train crew shall actively seek to contact the public security official on his arrival at the scene and shall make available for his examination the Emergency Response Forms, waybills, train consist and any other information to assist the public security forces in handling the dangerous commodities being transported.

(d) Where the classification or product identification number of dangerous commodities has been changed by the amendments to these regulations that came into force July 1, 1985, Emergency Response Forms used in respect of those dangerous commodities prior to that date may continue to be used until December 31, 1985.

(e) Until December 31, 1985 shippers wishing to utilize the Emergency Response Form as a shipping document may alter Sample 1 to the format shown in Sample 2. Further information, if any, required to be shown on the shipping document may be added at the bottom of the Form where the Shipper's Certificate was previously located.

(f) Shippers with facilities for producing Emergency Response Forms electronically may use the Form as shown in Samples 3 and 3A. The "Commodity Name" must be highlighted as shown in Samples 3 or 3A or by similarly effective means.

(g) Small changes in graphics on Emergency Response Forms may be authorized by the Director of Operation, R.T.C.

(h) A sample (reduced size) Emergency Response Form follows.

APPENDIX A — COPIES OF EMERGENCY RESPONSE[1] FORMS

The following statements formerly required at the bottom of the Emergency Response Forms are no longer required and may be removed:

"This is to certify that the above named article is properly classified, described, packaged, marked and labelled, and is in proper condition for transportation according to the applicable regulations of the Canadian Transport Commission." and "Il est par les présentes certifié que le produit susmentionné est convenablement classifié, décrit, emballé, marqué et étiqueté et en bon état de transport conformément aux règles applicables de la Commission Canadienne des Transports."

[1] The titles shall be in letters at least 4 mm high.

[2] The headings shall be in letters at least 2.5 mm high.

[1] A sample copy of any approved Emergency Response Form is available upon request.

APPENDIX A
SAMPLE 1
Front Side

EMERGENCY RESPONSE FORM
(reduced size)
(black printing on white)

URGENT

Emergency Response Form
SPECIAL COMMODITY

Fiche de sécurité
MARCHANDISE SPÉCIALE

Liquefied Petroleum Gases UN 1075

Flammable Gas 2.1

Gaz de pétrole liquéfiés UN 1075

Gaz inflammable 2.1

Car Wagon ☐ Trailer Remorque ☐ Container Conteneur ☐ N° _____

Content Weight
Masse du contenu _____

If compartmentized check one
Si le produit se trouve dans un compartiment cocher A ☐ B ☐ C ☐ D ☐

Shipper-designated 24-hour emergency telephone numbers
Nos de telephone fournis par l'expediteur en cas d'urgence (24 heures sur 24)

1) _____

2) _____

IMMEDIATE ACTION INFORMATION

General:
Keep upwind. Do not smoke. No flares or open flame. Isolate the hazard area.

Spill or Leak:
Isolate affected area. Beware of heavy gases or fumes which hug the ground. Use flooding quantities of water fog or spray to knock down vapors. Prevent knock down water from entering sewers, drains or streams. Stop the leak if without risk. Protect operators by water spray.

Fire:
Do not put out fire until leak is stopped. If possible, cool containers with flooding quantities of water. Use water in flooding quantities as a fog. If an engulfing fire threatens but safe procedure permits, set up unmanned hose streams. If this is impossible let fire burn. Evacuate to a minimum distance of 1000 meters.

First Aid:
Remove victim to fresh air. Apply artificial respiration. Flush eyes and skin burns with low pressure water for at least 15 minutes. Seek medical aid.

MESURES D'URGENCE

Consignes générales:
Rester en amont du vent. Ne pas fumer. Éloigner torches et flammes nues. Isoler la zone dangereuse

Déversement ou fuite:
Isoler la zone dangereuse. Prendre garde aux gaz ou aux vapeurs qui se tiennent au ras du sol. Arroser abondamment avec de l'eau en pluie ou en brouillard pour abattre les vapeurs. Empêcher l'eau d'aller dans les conduites d'évacuation ou les cours d'eau. S'il n'y a pas de risques, colmater la fuite. Arroser le personnel d'intervention pour le protéger.

Incendie:
Arrêter la fuite avant d'éteindre l'incendie. Si possible refroidir les contenants avec des quantités abondantes d'eau. Arroser abondamment avec de l'eau en brouillard. Si l'incendie menace et que la sécurité le permet installer des boyaux fixes, non opérés par du personnel. Si ceci est impossible laisser brûler. Evacuer dans un rayon d'au moins 1000 mètres.

Secourisme:
Transporter la victime à l'air frais. Appliquer la respiration artificielle. En cas de brûlure, rincer abondamment les yeux ou la partie touchée avec un fin jet d'eau pendant au moins 15 minutes. Appeler le service médical.

Placard Notation
Mention d'etiquetage _____

Origin
Origine _____

Shipper
Expediteur _____

Destination
Destination _____

Consignee
Destinataire _____

Routing
Itineraire _____

Date _____

Signature _____

NOTE: The Notations "Special Commodity" and "Marchandise Spéciale" are to be shown only for commodities designated as Special Commodities in § 72.5.

SAMPLE 1

EMERGENCY RESPONSE FORM
Reverse Side
(reduced size)

URGENT

SPECIAL COMMODITY **MARCHANDISE SPÉCIALE**

Liquefied Petroleum Gases UN 1075

Flammable Gas 2.1

Immediate Action Information
on other side of this sheet

GENERAL CHARACTERISTICS

Liquefied Petroleum gases is a mixture of propane, butane and other gases, natural gas, or gases from petroleum refineries. It has a faint but characteristic odour. For transportation it may be stenched. It is shipped as a liquefied gas under its own vapour pressure which depending on the particular mixture may vary from 200 to 1000 kPa gage (28 to 145 psig) at 30°C. The liquid vapourizes at ordinary ambient temperatures. Leaks may occur in either liquid or gaseous form. The cold vapour hugs the ground and collects in hollows. Since the gas is flammable flashbacks from ignitions to leaks are common. Contact with the cold liquid causes frostbite and breathing of high concentrations of the associated gas can cause death by asphyxiation. Under fire conditions cylinders can rupture and rocket.

POTENTIAL HAZARDS

Fire:

Do not smoke. Easily ignited by heat, sparks, flame or non-flame proof electrical apparatus. Since vapor is heavier than air fire can flash back to source of leaks Heated containers may rupture violently and rocket. Vapors entering sewers, or other closed spaces, will create an explosion hazard. Liquid fires should be fought with foam, carbon dioxide or dry chemical extinguishers. Water when necessary should be applied as a fog from a far distance

Explosion:

Vapors may form explosive mixtures with air

Health:

Breathing of the vapours may cause dizziness and unconsciousness. The material may cause asphyxiation by displacement of air. Contact with the liquid may cause frostbite

Gaz de pétrole liquéfiés UN 1075

Gaz inflammable 2.1

Mesures d'urgence au verso

RENSEIGNEMENTS GÉNÉRAUX

Le gaz de pétrole liquefié est un mélange de propane, de butane et d'autres gaz, de gaz naturel ou de gaz provenant de raffineries de petrole. Il a une odeur faible mais caractéristique. On peut l'empuantir pour le transport. Il est expédié sous forme de gaz liquéfié sous sa propre tension de vapeur qui peut varier de 200 à 1000 kPa mesuré (28 à 145 lbs/po^2) à 30° C dépendant du mélange particulier. Le liquide se vaporise à temperature ambiante. Les fuites peuvent être sous forme liquides ou gazeuses Les vapeurs ont tendance a se tenir au ras du sol et à s'accumuler dans les zones basses. Étant donné que le gaz est inflammable les retours de flamme au point de fuite sont à craindre. Un contact avec le liquide peut causer des geluses et l'inhalation des vapeurs peut causer la mort par asphyxie Dans les conditions d'incendie les bonbonnes peuvent se rompre violemment et être propulsées à distance.

DANGERS

Incendie:

Ne pas fumer. S'enflamme facilement par la chaleur, les étincelles, une flamme ou au contact d'un dispositif électrique non à l'épreuve du feu. Étant donné que les vapeurs sont plus lourdes que l'air le feu peut remonter au point de fuite. Les contenants surchauffés peuvent se rompre violemment et être propulsés à distance. Les vapeurs s'infiltrant dans les égouts ou autres espaces clos vont créer un risque d'explosion. Le liquide enflammé devrait être éteint avec un extincteur à mousse, bioxyde de carbone ou à poudre sèche. S'il faut se servir d'eau, l'appliquer en brouillard en se tenant à distance

Explosion:

Les vapeurs peuvent former un mélange explosif avec l'air

Santé:

L'inhalation des vapeurs peut causer des étourdissements et l'évanouissement. Peut causer l'asphyxie par déplacement d'air. Le contact avec le liquide peut provoquer des gelures.

SAMPLE 2
Front Side

EMERGENCY RESPONSE FORM
(reduced size)
(black printing on white)

URGENT

Emergency Response Form

Fiche de sécurité

GASOLINE

Class 3.1 UN 1203
Pkg. Group II
Consignor Address
Consignee Address
Shipping Document Number

Essence, UN 1203

Liquide inflammable 3.1

Car / Wagon ☐ Trailer / Remorque ☐ Container / Conteneur ☐ N° _____

Content Weight
Masse du contenu _____

If compartmentized check one
Si le produit se trouve dans un compartiment, cocher ☐ A ☐ B ☐ C ☐ D

Shipper-designated 24-hour emergency telephone numbers
Nos de téléphone fournis par l'expéditeur en cas d'urgence (24 heures sur 24)

1) _____

2) _____

IMMEDIATE ACTION INFORMATION

General:
Keep upwind. Do not smoke. No flares, open flames or electrical apparatus which is not flame proof. Isolate the hazard area.

Spill or Leak:
Beware of heavy gases or fumes which hug the ground. Use flooding quantities of water fog or spray to knock-down vapors. Stop the leak if without risk. Absorb small residues with fly ash, cement powder, dry earth or sand For large spills dike with sand or earth for later disposal. Cover liquid pools with protein foam to reduce vaporization. Keep area isolated.

Fire:
Do not put out fire until leak is stopped. If only a small fire use carbon dioxide, foam or dry chemical extinguishers. If fire is large use water in flooding quantities as a fog. If possible, cool containers with flooding quantities of water. Keep clear of ends of tank. If an engulfing fire threatens but safe procedure permits, set up unmanned hose streams. If a bulk container or tank car load becomes immersed in fire evacuate to 1000 meters.

First Aid:
For burns use standard first aid procedures. Seek medical aid. Wash material from uninjured skin preferably with soap and water. Flush eyes and skin irritations with low pressure water for at least 15 minutes. Apply artificial respiration if necessary.

MESURES D'URGENCE

Consignes générales:
Rester en amont du vent. Ne pas fumer. Éloigner torches, flammes nues ou les dispositifs électriques qui ne sont pas à l'épreuve du feu. Isoler la zone dangereuse.

Déversement ou fuite:
Prendre garde aux gaz ou aux vapeurs qui se tiennent au ras du sol. Arroser abondamment avec de l'eau en pluie ou en brouillard pour abattre les vapeurs. S'il n'y a pas de risques, colmater la fuite. Absorber les petits résidus au moyen de cendre, de poudre de ciment, de terre sèche ou de sable. Pour les épandages importants endiguer avec de la terre ou du sable pour disposition future. Recouvrir les flaques liquides avec de la mousse protéique pour réduire l'évaporation. Garder la zone isolée

Incendie:
Arrêter la fuite avant d'éteindre l'incendie. Si l'incendie est faible utiliser des extincteurs à bioxyde de carbone, à mousse ou à poudre sèche. Si l'incendie est important arroser abondamment avec de l'eau en brouillard. Si possible, refroidir les contenants avec des quantités abondantes d'eau. Se tenir éloigné des extrémités des citernes. Si l'incendie menace et que la sécurité le permet installer des boyaux fixes, non opérés par du personnel. Lorsqu'un conteneur de vrac ou un wagon-citerne est environné de flammes évacuer à 1000 mètres.

Secourisme:
Pour les brûlures appliquer les premiers soins. Appeler le service médical. Laver la peau non blessée de préférence à l'eau et au savon pour enlever le produit. En cas d'irritations, rincer abondamment les yeux ou la partie touchée avec un fin jet d'eau pendant au moins 15 minutes. Appliquer la respiration artificielle si nécessaire.

Placard Notation
Mention d'étiquetage _____

Shipper
Expéditeur _____

Consignee
Destinataire _____

Origin
Origine _____

Destination
Destination _____

Routing
Itinéraire _____

Date _____

Signature: _____

NOTE: The Notations "Special Commodity" and "Marchandise Spéciale" are to be shown only for commodities designated as Special Commodities in § 72.5.

SAMPLE 2

EMERGENCY RESPONSE FORM
Reverse Side
(reduced size)

URGENT

Gasoline, UN 1203

Flammable liquid 3.1

Immediate Action Information
on other side of this sheet

GENERAL CHARACTERISTICS

Gasoline has a characteristic petroleum odour. It has a flash point below -18°C (0°F). The vapour is heavier than air and the liquid is lighter than water. Gasoline is insoluble in water.

POTENTIAL HAZARDS

Fire:
Do not smoke. Easily ignited by heat, sparks, flames or non-flame proof electrical apparatus. Fire can flash back to source of leak. Heated containers may rupture violently and rocket. Vapours entering sewers, or other closed spaces, will create an explosion hazard. Water when necessary should be applied as a fog from a far distance

Explosion:
Vapours form explosive mixtures with air.

Health:
Breathing of vapours may cause dizziness and unconsciousness. Contaminated clothing will induce severe skin irritation

Essence, UN 1203

Liquide inflammable 3.1

Mesures d'urgence au verso

RENSEIGNEMENTS GÉNÉRAUX

L'essence a une odeur caractéristique de pétrole. Elle a un point d'éclair inférieur à -18°C (0°F). Les vapeurs sont plus lourdes que l'air et le liquide est plus léger que l'eau. L'essence est insoluble dans l'eau

DANGERS

Incendie:
Ne pas fumer. S'enflamme facilement par la chaleur, les étincelles, une flamme ou au contact d'un dispositif électrique non à l'épreuve du feu. Le feu peut remonter au point de fuite. Les contenants surchauffés peuvent se rompre violemment et être propulsés à distance. Les vapeurs s'infiltrant dans les égouts, ou autres espaces clos, vont créer un risque d'explosion. S'il faut se servir d'eau, l'appliquer en brouillard en se tenant à distance

Explosion:
Les vapeurs forment un mélange explosif avec l'air

Santé:
L'inhalation des vapeurs peut causer des étourdissements et l'évanouissement. Les vêtements contaminés irriteront gravement la peau

SAMPLE 3
Front Side

EMERGENCY RESPONSE FORM
(reduced size)
(black printing on white)

URGENT

Emergency Response Form

SPECIAL COMMODITY

AMMONIA ANHYDROUS

Class 2.4 (9.2) UN 1005

Placards / Plaques —

Unit No. / No de l'unité —

E.R.P. / R.P.U. —

EMERGENCY / URGENCE 24 H. TÉL. / TELEPHONE NO. —

Origin / Origine —

Consignor / Expéditeur —

Address /Adresse —

Consignee / Destinataire —

Address / Adresse —

Routing / Itinéraire —

Fiche de sécurité

MARCHANDISE SPÉCIALE

AMMONIAC ANHYDRE

Classe 2.4 (9.2) UN 1005

Quantity / Volume / Quantité —

TÉL. / TELEPHONE NO. —

Destination —

If compartmentized indicate Compartment / Si en compartiments indiquer le compartiment —

IMMEDIATE ACTION INFORMATION

General:
Keep upwind. Wear full protective clothing and self-contained breathing apparatus (SCBA). Prevent personal contact. For bulk quantities downwind evacuation must be considered. In cases of fire keep clear of ends of tanks.

Spill or Leak:
Even in the absence of fire, evacuate downwind areas for 1000 meters. Beware of heavy gases or fumes which hug the ground. Use flooding quantities of water fog or spray to knock-down vapors. Do not apply water directly to leak or to liquid pools. Keep area isolated until gas is dispersed.

Fire:
If possible, cool containers with flooding quantities of water. If an engulfing fire threatens but safe procedure permits, set up unmanned hose streams. If a bulk container or tank car load becomes immersed in fire evacuate to 1000 meters. Evacuation up to 7 km downwind and 1 km upwind may have to be considered.

First Aid:
Remove victim to fresh air. Prompt medical attention is essential. Keep patient warm and at rest. Do not leave him unattended. Remove contaminated clothing. Flush eyes and skin burns with low pressure water for at least 30 minutes.

MESURES D'URGENCE

Consignes générales:
Rester en amont du vent. Porter une tenue de protection complète et un appareil respiratoire autonome. Éviter les contacts. Pour les quantités importantes, l'évacuation de la zone sous le vent doit être considérée. En cas d'incendie se tenir éloigné des extrémités des citernes.

Déversement ou fuite:
Évacuer la zone sous le vent dans un rayon de 1000 mètres même en l'absence d'incendie. Prendre garde aux gaz ou aux vapeurs qui se tiennent au ras du sol. Arroser abondamment avec de l'eau en pluie ou en brouillard pour abattre les vapeurs. Ne pas appliquer d'eau directement sur la fuite ou sur les flaques. Garder la zone isolée jusqu'à ce que le gaz soit dispersé.

Incendie:
Si possible, refroidir les contenants avec des quantités abondantes d'eau. Si l'incendie menace et que la sécurité le permet installer des boyaux fixes, non opérés par du personnel. Lorsqu'un conteneur de vrac ou un wagon-citerne est environnée de flammes évacuer à 1000 mètres. L'évacuation d'une zone de 7 km sous le vent et de 1 km en amont du vent pourrait être nécessaire.

Secourisme:
Transporter la victime à l'air frais. Des soins médicaux urgents sont essentiels. Garder le patient au chaud et au repos. Ne pas le laisser sans surveillance. Enlever les vêtements contaminés. En cas de brûlure, rincer abondamment les yeux ou la partie touchée avec un fin jet d'eau pendant au moins 30 minutes.

Date _____ Document No _____ Signature _____

NOTE: The Notations "Special Commodity" and "Marchandise Spéciale" are to be shown only for commodities designated as Special Commodities in § 72.5.

SAMPLE 3

EMERGENCY RESPONSE FORM
Reverse Side
(reduced size)

URGENT

SPECIAL COMMODITY

AMMONIA, ANHYDROUS,
Class 2.4 (9.2) UN 1005

Immediate Action Information
on other side of this sheet

GENERAL CHARACTERISTICS

Ammonia is a clear flammable gas with a choking odour. It is shipped as a liquid under its own vapour pressure which at 30°C is 1100 KPa gage (158 psig). It is corrosive to tissue and to metals. It is soluble in water forming a corrosive liquid. In high concentrations (16–25%) ammonia vapour will burn. The gas is corrosive to lungs, eyes and mucous membranes generally. Only moderate concentrations cause choking and inability to breathe. The chilled gas from a leak may accumulate in low-lying areas.

POTENTIAL HAZARDS

Fire:
The gas forms explosive mixtures with air. Easily ignited by heat, sparks or flame. Heated containers may rupture violently and rocket.

Health:
Fumes are corrosive to the eyes, mucous membranes and skin. The fumes make breathing difficult. Breathing of only moderate concentrations of the gas may prove fatal. Contact or contaminated clothing causes severe burns.

MARCHANDISE SPÉCIALE

AMMONIAC ANHYDRE,
Classe 2.4 (9.2) UN 1005

Mesures d'urgence au verso

RENSEIGNEMENTS GÉNÉRAUX

L'ammoniac est un gaz clair et incolore à odeur suffocante. Il est expédié liquide sous sa propre tension de vapeur soit 1100 KPa (158 lbs/po²) à 30°C. Il corrode les métaux et les tissus. Il est soluble dans l'eau avec laquelle il forme un liquide corrosif. Les vapeurs d'ammoniac en fortes concentrations (16-25%) vont brûler. Le gaz est généralement corrosif pour les poumons, les yeux et les muqueuses. Des concentrations modérées peuvent causer des étouffements et une incapacité à respirer. Le gaz froid provenant d'une fuite peut s'accumuler dans les zones basses.

DANGERS

Incendie:
Les gaz forment des mélanges explosifs avec l'air. S'enflamme facilement par la chaleur, les étincelles ou une flamme. Les contenants surchauffés peuvent se rompre violemment et être propulsés à distance.

Santé:
Les vapeurs sont corrosives pour les yeux, la peau et les muqueuses. Les vapeurs rendent la respiration difficile. L'inhalation de concentrations modérées du gaz peut être fatale. Les contacts ou les vêtements contaminés causent des brûlures sévères.

SAMPLE 3A
Front Side

EMERGENCY RESPONSE FORM
(reduced size)
(black printing on white)

URGENT

Emergency Response Form
SPECIAL COMMODITY

***** AMMONIA ANHYDROUS *****
Class 2.4 (9.2) UN 1005
Placards / Plaques —
Unit No. / No de l'unité —
E.R.P. / R.P.U. —
EMERGENCY / URGENCE 24 H. TÉL. / TELEPHONE NO. —

Fiche de sécurité
MARCHANDISE SPÉCIALE

***** AMMONIAC ANHYDRE *****
Classe 2.4 (9.2) UN 1005

Quantity / Volume / Quantité —
TÉL. / TELEPHONE NO. —

Origin / Origine —
Consignor / Expéditeur —
Address /Adresse —
Consignee / Destinataire —
Address / Adresse —
Routing / Itinéraire —

Destination —

If compartmentized indicate Compartment / Si en compartiments indiquer le compartiment —

IMMEDIATE ACTION INFORMATION

General:
Keep upwind. Wear full protective clothing and self-contained breathing apparatus (SCBA). Prevent personal contact. For bulk quantities downwind evacuation must be considered. In cases of fire keep clear of ends of tanks.

Spill or Leak:
Even in the absence of fire, evacuate downwind areas for 1000 meters. Beware of heavy gases or fumes which hug the ground. Use flooding quantities of water fog or spray to knock-down vapors. Do not apply water directly to leak or to liquid pools. Keep area isolated until gas is dispersed.

Fire:
If possible, cool containers with flooding quantities of water. If an engulfing fire threatens but safe procedure permits, set up unmanned hose streams. If a bulk container or tank car load becomes immersed in fire evacuate to 1000 meters. Evacuation up to 7 km downwind and 1 km upwind may have to be considered.

First Aid:
Remove victim to fresh air. Prompt medical attention is essential. Keep patient warm and at rest. Do not leave him unattended. Remove contaminated clothing. Flush eyes and skin burns with low pressure water for at least 30 minutes.

MESURES D'URGENCE

Consignes générales:
Rester en amont du vent. Porter une tenue de protection complète et un appareil respiratoire autonome. Éviter les contacts. Pour les quantités importantes, l'évacuation de la zone sous le vent doit être considérée. En cas d'incendie se tenir éloigné des extrémités des citernes.

Déversement ou fuite:
Évacuer la zone sous le vent dans un rayon de 1000 mètres même en l'absence d'incendie. Prendre garde aux gaz ou aux vapeurs qui se tiennent au ras du sol. Arroser abondamment avec de l'eau en pluie ou en brouillard pour abattre les vapeurs. Ne pas appliquer d'eau directement sur la fuite ou sur les flaques. Garder la zone isolée jusqu'à ce que le gaz soit dispersé.

Incendie:
Si possible, refroidir les contenants avec des quantités abondantes d'eau. Si l'incendie menace et que la sécurité le permet installer des boyaux fixes, non opérés par du personnel. Lorsqu'un conteneur de vrac ou un wagon-citerne est environnée de flammes évacuer à 1000 mètres. L'évacuation d'une zone de 7 km sous le vent et de 1 km en amont du vent pourrait être nécessaire.

Secourisme:
Transporter la victime à l'air frais. Des soins médicaux urgents sont essentiels. Garder le patient au chaud et au repos. Ne pas le laisser sans surveillance. Enlever les vêtements contaminés. En cas de brûlure, rincer abondamment les yeux ou la partie touchée avec un fin jet d'eau pendant au moins 30 minutes.

Date: _____ Document No. _____

Signature: _____

NOTE: The Notations "Special Commodity" and "Marchandise Spéciale" are to be shown only for commodities designated as Special Commodities in § 72.5.

SAMPLE 3A

EMERGENCY RESPONSE FORM
Reverse Side
(reduced size)

URGENT

SPECIAL COMMODITY

*** AMMONIA, ANHYDROUS, ***
Class 2.4 (9.2) UN 1005

Immediate Action Information
on other side of this sheet

MARCHANDISE SPÉCIALE

*** AMMONIAC ANHYDRE, ***
Classe 2.4 (9.2) UN 1005

Mesures d'urgence au verso

GENERAL CHARACTERISTICS

Ammonia is a clear flammable gas with a choking odour. It is shipped as a liquid under its own vapour pressure which at 30°C is 1100 KPa gage (158 psig). It is corrosive to tissue and to metals. It is soluble in water forming a corrosive liquid. In high concentrations (16–25%) ammonia vapour will burn. The gas is corrosive to lungs, eyes and mucous membranes generally. Only moderate concentrations cause choking and inability to breathe. The chilled gas from a leak may accumulate in low-lying areas.

RENSEIGNEMENTS GÉNÉRAUX

L'ammoniac est un gaz clair et incolore à odeur suffocante. Il est expédié liquide sous sa propre tension de vapeur soit 1100 KPa (158 lbs/po^2) à 30°C. Il corrode les métaux et les tissus. Il est soluble dans l'eau avec laquelle il forme un liquide corrosif. Les vapeurs d'ammoniac en fortes concentrations (16-25%) vont brûler. Le gaz est généralement corrosif pour les poumons, les yeux et les muqueuses. Des concentrations modérées peuvent causer des étouffements et une incapacité à respirer. Le gaz froid provenant d'une fuite peut s'accumuler dans les zones basses.

POTENTIAL HAZARDS

Fire:
The gas forms explosive mixtures with air. Easily ignited by heat, sparks or flame. Heated containers may rupture violently and rocket.

Health:
Fumes are corrosive to the eyes, mucous membranes and skin. The fumes make breathing difficult. Breathing of only moderate concentrations of the gas may prove fatal. Contact or contaminated clothing causes severe burns.

DANGERS

Incendie:
Les gaz forment des mélanges explosifs avec l'air. S'enflamme facilement par la chaleur, les étincelles ou une flamme. Les contenants surchauffés peuvent se rompre violemment et être propulsés à distance.

Santé:
Les vapeurs sont corrosives pour les yeux, la peau et les muqueuses. Les vapeurs rendent la respiration difficile. L'inhalation de concentrations modérées du gaz peut être fatale. Les contacts ou les vêtements contaminés causent des brûlures sévères.

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APPENDIX B — Procedure for Testing Chemical Compatibility and Rate of Permeation in Polyethylene Packaging and Receptacles.

1. The purpose of this procedure is to determine the chemical compatibility and permeability of liquid dangerous goods packaged in polyethylene packaging and receptacles. Alternatives to this procedure are permitted as specified in § 73.24(e)(3) of this part.

2 Compatibility and rate of permeation are determined by subjecting full size polyethylene containers (or smaller containers as permitted in paragraph 4 of this Appendix) and dangerous goods lading to one of the following combinations of time and temperature:

a. Test Method 1: 180 days at a temperature no lower than 18°C. (64°F)

b. Test Method 2: 28 days at a temperature no lower than 50°C. (122°F.)

c. Test Method 3: 14 days at a temperature no lower than 60°C. (140°F.)

3. Regardless of which test method is used, at least three sample containers shall be tested for each combination of dangerous goods and size and design of container. Fill containers to rated capacity with the specific dangerous goods (at the concentration to be transported) and close as for shipment. For the first and last 24 hours of storage under the selected test method, place the containers with closures downward, except that containers fitted with a vent are so placed on each occasion for five minutes only.

4. For testing under Test Method 2 or 3 in those instances where it is not practicable to use full size containers, smaller containers may be used. The small container shall be manufactured by the same process as the larger container (for example, using the same method of molding and processing temperatures) and be made of identical resins, pigments and additives.

5. Determine filled container weight or net weight of contents both before and after storage under the selected test method. Rate of permeation is determined from loss of dangerous goods contents, during the conduct of the test, expressed as a percentage of the original weight.

6. After storage under the selected test method, the container shall be drained, rinsed, filled to rated capacity with water and, with filled container at ambient temperature, dropped from a height of 1.2 meters (3.94 feet) onto solid concrete.

7. Each of the following constitutes test failure:

a. Visible evidence of permanent deformation due to vapor pressure build-up or collapse of walls, deterioration, swelling, crazing, cracking, excessive corrosion, oxidization, embrittlement, leakage, rupture or other defects likely to indicate premature failure or a hazardous condition.

b. For materials meeting the definition of a poisonous substance, a rate of permeation in excess of 0.5% determined over the test period. For all other dangerous goods, a rate of permeation in excess of 2.0% determined over the test period.

Part 74—REGULATIONS APPLYING TO CARRIERS

Sec.

74.501 Securing commodities in rail cars.
74.503 "Order—notify," "C.O.D." and "Stop-off" shipments.
74.504 Less than carload shipments of carrier material and supplies
74.505 Transfer of OCS Fuel on Railway Property.

Subpart A—Selection, Preparation, Loading and Inspection of Cars

74.525 Selection, preparation and inspection, Divisions 1.1 and 1.2 explosives.
74.526 Loading and inspection, Divisions 1.1 and 1.2 explosives.
74.526a Inspection certificates, Divisions 1.1 and 1.2 explosives.
74.527 Forbidden mixed loading and storage.
74.528 Protect explosives from injury.
74.529 Cars for division 1.3 explosives.
74.530 Cars for division 1,4 explosives.
74.532 Loading other dangerous goods.
74.533 Truck bodies or trailers on flat cars.
74.534 Portable containers or tanks.
74.538 Forbidden mixed loading of dangerous goods

Subpart D—Unloading From Cars

74.560 Carload shipments and delivery.
74.561 Tank car loading and unloading.
74.566 Cleaning cars.
74.567 Flammable vapors.
74.568 Forbidden explosive unloading sites.

Subpart E—Handling by Carriers by Rail Freight

74.575 Restrictions.
74.578 Flammable vapors.
74.580 Violations must be corrected.
74.581 Routing shipments.
74.582 Movement to be expedited.
74.589 Handling cars.
74.590 Record of change of seals of cars of explosives to be made.
74.591 Car magazines.
74.594 Acceptable Emission Limits for Tank Cars.
74.596 Inspection of rail cars.
74.597 Railway gateway inspection
74.598 Inspection of cars at interchange.
74.599 Handling on self propelled cars.
74.601 Calcium hypochlorite compounds, dry, involved in fires.

§ 74.501 Securing commodities in rail cars. (a) Commodities must be loaded, stayed, blocked and braced so as to prevent their movement and so as to prevent damage to them when subjected to an impact from either end of eight miles per hour. Ends, sidewalls and doors of vehicles must not be relied upon to prevent the shifting of the load. Methods of manufacture, packing and storage in so far as they affect safety in transportation, must be open to inspection by a duly authorized representative of the initial carrier or of the Commission. Shipments of dangerous commodities not in proper condition for transportation, or loaded or stayed as required, or certified as to proper packing, marking and description as required in these regulations, must not be accepted for transportation or transported.

(b) Import and export shipments shall conform with the requirements of §§73.8 and 73.9 of the Commission's Regulations for the Transportation of Dangerous Commodities by Rail.

[1] Detailed procedures for conducting the impact test may be obtained from the Director of Operation, R.T.C.

§ 74.503 "Order-Notify," "C.O.D.," and "Stop-off" shipments. (a)Except on through bills of lading to a foreign country, shipments of explosives, division 1.1 or division 1.2, and blasting caps in any quantity must not be accepted for transportation or transported by carrier by rail freight when consigned "to order notify" or "C.O.D." Shippers must not consign these shipments to themselves at points where they have not a resident representative.

(b)Explosives, division 1.1 or division 1.2, must not be accepted for transportation or transported by carrier by rail freight subject to "stop-off" privileges en route for partial loading or unloading.

§ 74.504 Less than carload shipments of carriers' Material and Supplies (a) Subject to this section, these regulations apply to dangerous commodities which are transported on company service (OCS) by and for the use of a carrier, other than dangerous commodities transported between a carrier's stores departments.

(b) The following are exempt from the packaging requirements of Part 73:

(1) Packages of OCS materials other than compressed gas cylinders in UL or CSA approved containers of not more than 5 gallons capacity having closures of a type that will prevent continuous venting of the contents.

(2) Railway fusees packaged in closed strong metal, fiberglass or wooden containers or held in place in fusee racks.

(3) Signals, railway track explosives (torpedoes) packaged in closed strong metal, fiberglass or wood containers.

Railway fusees and signals, railway track explosives carried on passenger trains shall be enclosed in strong metal, fiberglass or wooden containers.

(c)Loading, blocking, bracing and segregation shall be in accordance with the requirements of Part 73 and this Part.

(d) The shipping document issued shall accompany the shipment from origin to destination and be in the possession of the train or work crew and be readily accessible at all times.

(e) Carload shipments of dangerous commodities shall be accompanied by an Emergency Response Form in accordance with section 73.429.

(f) Carriers are not required to empty remaining flammable liquids from internal combustion engines, lines or fuel tanks of equipment used for OCS purposes.

(g) The requirements of section 74.582 regarding the expediting of movements do not apply to OCS shipments.

§ 74.505 Transfer of OCS Fuel on Railway Property. (a) Notwithstanding the provisions of § 74.560, and subject to the provisions of paragraph (b) of this section, the following arrangements covering transfer of compressed gases and flamma-

ble liquids, for use by rail carriers are permitted to be performed on railway property:

(1) **Compressed Gases**

(i) Tank car to switch heater storage tanks.

(ii) Tank truck to switch heater storage tanks.

(iii) Tank truck to permanent storage tanks.

(iv) Tank truck to trailers, containers, and railway owned equipment such as towmotors, forklifts and track equipment.

(v) Storage tank to trailers and railway owned equipment.

(vi)Storage tank to cylinders.

(2) Permanent storage tanks referred to in subparagraph (a)(1) of this section must comply with the requirements of Part IX of General Order No. 0-31, "Regulations Respecting the Design, Location, Construction, Operation and Maintenance of Stationary Bulk Storage Facilities for Liquefied Petroleum Gases." The Director of Operation, R.T.C., shall be advised of all other transfer locations where transfers are made more than twelve times per year.

(3) **Flammable Liquids**

(i) Tank truck to storage tanks

(ii) Storage tanks to tank trucks and railway owned equipment

(iii) Tank trucks to railway owned equipment

(iv) Storage tanks to 45 gallon and similar capacity drums

(v) Portable container to portable container, for example, from drums to 5 gallon containers to company owned equipment

(4) Permanent storage tanks referred to in subparagraph (a)(3) must comply with General Order No. 0-32, "Regulations Respecting The Design, Location, Construction, Operation And Maintenance Of Stationary Bulk Storage Facilities For Flammable Liquids."

(b) Carriers shall ensure that the following restrictions are observed before and during any of the transfer operations outlined in this section:

(1) The carrier shall be responsible for the inspection and proper verification of portable tanks, containers and cylinders involved in the transfer of flammable compressed gases and flammable liquids and shall not employ any which are defective, or improperly marked including those with overdue retest dates.

(2) All train activity in the immediate vicinity shall be stopped while refuelling is in progress.

(3) Cars involved in refuelling shall have handbrakes applied, wheels properly blocked and a blue flag shall be erected while fueling is in progress.

(4) Signs prohibiting smoking shall be properly posted and observed.

(5) Appropriate fire extinguishers shall be present on site and readily available to railway employees performing the refuelling.

(6) Only those persons required for performing such transfers shall be in the immediate vicinity while such transfers are being carried out and transfers shall not be permitted in the immediate vicinity of occupied passenger cars, passenger stations or other locations where the public is liable to congregate.

(7) When fuelling switch heater storage tanks from tank car or modified stock car combination, the following procedure shall be observed.

(i) Fuelling operations from a train or the transportation on a train of hoses filled with propane shall not take place when the consist of the train includes other cars containing shipments of dangerous commodities or cars occupied by employees or passengers.

(ii) At least two buffer cars shall be placed at each end of the tank or modified car combination.

(iii) During unloading operation, handbrakes shall be applied and wheels blocked on both supply and transfer equipment cars.

(iv) After cars have been spotted, engine shall be uncoupled and moved a safe distance from transfer operation.

(8) Any incident or accident involving either storage or transfer of tanks, cylinders or containers shall be reported immediately to the Director of Operations, Railway Transport Committee.

SUBPART A—SELECTION, PREPARATION, LOADING AND INSPECTION OF CARS

§ 74.525 Selection, preparation and inspection, Divisions 1.1 and 1.2 explosives. (a) Selection of Cars.

(1) Subject to this paragraph and § 74.526 (n) and (o), dangerous goods classified in Division 1 or 2 of Class 1 must be loaded in closed cars, or in closed containers or trailers mounted on flat cars.

(2) Dangerous goods included in Division 1.1 or 1.2 may be loaded in closed containers or trailers subject to conditions imposed by the Director of Operation, R.T.C.

(3) Cars of not less than 80,000 pounds capacity, equipped with steel underframe and friction draft gear, must be used except that on narrow-gauge lines the available cars of greatest capacity and strength may be used.

(4) Cars equipped with any lighted heater or open-flame device, any electric device having exposed heating coils, or any apparatus or mechanism utilizing an internal combustion engine, must not be used.

(5) Stock cars, gondola cars (flat bottom) or flat cars, or open-top trailers, may be used for explosive bombs, unfused projectiles, rocket ammunition and rocket motors which, due to size, cannot be loaded in closed cars or closed trailers, as the case may be, if they are protected against weather and accidental ignition, and for metal containers of incendiary bombs weighing 500 pounds or more.

(6)Cars equipped with automobile loading devices must not be used unless device is securely attached to the roof of the car with fastenings supplementing those already provided and is so fixed that it cannot fall.

(b) Inspection and preparation of cars, containers and trailers. Closed cars, containers and trailers shall be inspected inside and outside in order to ensure that the following requirements are complied with.

(3)Roofs, sides, ends, floors and car linings must not have loose boards, cracks or holes through which sparks may enter, or decayed spots liable to hold sparks.

(4) Wooden roofs must be inspected from the outside for decayed spots or broken boards, which must be covered or repaired.

(5) The doors must shut closely enough that no sparks can get in and, if necessary, they must be stripped on the inside. The stripping should be fastened to the door frames to form a shoulder against which the closed doors are pressed by means of wedges or cleats in door shoes or keepers. The openings under the doors should be similarly closed. The hasp fastening must be examined with doors closed and fastened, and the doors must be cleated when necessary to prevent them from shifting. If doors are opened during transit, wedges or cleats must be replaced before car proceeds.

(7) The floor must be swept clean before the explosives are loaded.

(8) The floor and lining must be free from projecting nails, bolts or exposed pieces of metal which may work loose or produce holes in packages during transit. If necessary for the purpose of fastening the floor or lining, new nails must be driven through other parts thereof.

(9) Metal floor plates must be completely covered with wood, plywood, fibre or composition sheets of adequate thickness and strength to prevent contact of the floor plates with packages during transit, except for carload shipments loaded by the Department of National Defence provided the explosives are not liable to leakage of explosive dust, powder or vapour.

(c) Inspection of journals and brakes.

(1) The journal boxes and trucks of cars must be examined and put in condition to minimize the danger of hot-boxes or other failure during transit.

(2) Air brakes must be tested and hand brakes checked for defects.

(d) Certification of cars, containers and trailers.

(1) Before a car is furnished by a carrier for loading with Division 1.1 or 1.2 explosives it shall be thoroughly inspected for compliance with this section by a competent employee of the carrier, who shall sign in triplicate section 1 of the Car Certificate prescribed by §74.527.

(2) Before a container or trailer containing Division 1.1 or 1.2 explosives is loaded onto a flat car, a competent employee of the carrier shall inspect the car for compliance with paragraph (c) and sign in triplicate section 1 of the Car Certificate prescribed by §74.527.

(3) This section does not apply to blasting caps or electric blasting caps in quantity not exceeding 1,000 caps, which may be loaded into any closed car in good condition without Car Certificates.

§ 74.526 Loading and inspection, Divisions 1.1 and 1.2 explosives. (a) Boxes or other containers of division 1.1 or 1.2 explosives when marked "THIS SIDE UP" must be loaded accordingly. Boxes may be loaded crosswise or lengthwise of the car, but not so that the ends of wooden boxes will bear against the sides of fibreboard boxes, or so that the end of any box will cause a high pressure on a small area of another box.

(c) Boxes of high explosives, low explosives, or black powder, packed in long cartridges, bags or siftproof liners, and containing no liquid explosive ingredient, may be loaded on their sides or ends, but not so that the end of a box will cause a high pressure on a small area of another box.

(d) Explosives must not be loaded higher than the permanent car lining unless additional lining is provided as high as the lading.

(e) When the lading of a car consists of or includes any explosives, the weight of the lading should be distributed so that it will be equalized on each side of the car and over the trucks.

(f) Explosives packed in metal kegs, except when boxed, must be loaded on their sides with their ends toward the ends of the car; packages of explosives must not be placed in the space opposite the doors unless the doorways are boarded on the inside as high as the lading. (This does not apply to palletized packages provided they are braced so that they cannot fall or slide into the doorways during transit.)

(g) Wooden or fibre kegs, barrels, or drums, may be loaded on their sides or ends, as will best suit the conditions.

(h) In a car containing explosives, the explosives and any other freight must be loaded, and if necessary blocked and braced, so as to prevent

(i) injury to packages of explosives during transit,

(ii) change of position of packages by the ordinary shocks incident to transportation, or

(iii) the falling of packages during transit or the falling or sliding of anything on or against them.

(i) To prevent delays to local freight trains, when there are shipments of explosives for different destinations loaded in a "peddler car" or "way car," the shipments for each destination must be stayed separately.

(j) Forwarding and transfer stations for explosives must be provided with the necessary materials for staying.

(k) Shippers must furnish the material for staying packages of explosives loaded by them.

(n) Container cars or portable containers on flat cars or gondola cars (drop-bottom cars not authorized), when properly loaded, blocked, and braced to prevent change of position under conditions incident to normal transportation, may be used for any division 1.1 or division 1.2 explosive, except black powder packed in metal containers. Portable containers must be of a type approved by the Commission. They must be designed and maintained so as to be weathertight and so constructed that sparks cannot enter. Wooden containers must be painted or treated with fire-retardant material of a type approved by the Commission.

(1) Portable containers must be of such design and so braced that there will be no evidence of failure of the container or the bracing when subjected to impact from each end of at least 8 miles per hour. Efficiency shall be determined by actual test, using dummy loads equal in weight and general character to material to be shipped.

(3) Lading shall be so loaded, blocked, and braced within the container that it will not change position under impact from each end of at least 8 miles per hour.

(o) Explosives division 1.1, division 1.2 or division 1.3 may be loaded and transported in tight, closed truck bodies or trailers on flat cars; and wooden boxed bombs, rocket ammunition, and rocket motors, division 1.1 or 1.2, or division 1.3 explosives, which due to their size cannot be loaded in tight, closed truck bodies or trailers, may be loaded in or on open-top truck bodies or trailers, but must be protected against accidental ignition, provided all of the following requirements are fulfilled and provided wooden containers are painted or treated with fire retardant and waterproof material of a type approved by the Commission:

(1) The basic structure consisting of frame, axles, et cetera

must be of sufficient strength to ensure that the lading will be adequately supported and protected under all conditions normally incident to transportation by rail.

(2) Truck body or trailer shall be so secured on the car that it will not permanently change position or show evidence of failure or impending failure of the method of securing truck body or trailer under impact from each end of at least 8 miles per hour. Efficiency shall be determined by actual test, using dummy loads equal in weight and general character to the material to be shipped.

NOTE 1: For recommended methods of blocking and bracing see Bureau of Explosives' Pamphlet 6C.

(3) Lading shall be so loaded, blocked, and braced within or on the truck body or trailer that it will not change position under impact from each end of at least 8 miles per hour.

NOTE 1: for recommended methods of blocking and bracing see Bureau of Explosives' Pamphlet 6C. Impact tests have been conducted on methods shown in this pamphlet.

(5) All fuel tanks for heaters or refrigerating machinery with which truck bodies or trailers are equipped shall be drained and all automatic heating or refrigerating machinery shall be rendered inoperative by disconnection of the automatic controls or the source of power for their operation.

(q) Certification of loaded car, container or trailer.

(1) Before a loaded car is accepted for transportation a competent employee of the carrier and, where it was loaded by the shipper, the shipper's authorized agent shall inspect the finished load for compliance with § 74.525 and this section and shall sign section 2 of the Car Certificate prescribed by § 74.527.

§ 74.526a Inspection certificates, Divisions 1.1 and 1.2 explosives. (a) The following Car Certificate is prescribed for the purposes of this Part. The original must be filed by the carrier at the forwarding station on a separate file; and the other two must be attached one to each side of the car on the placard board.

. . . . . Railway

CAR CERTIFICATE

Section 1

Car No . . . . Station. . . . . Date. . . . . .

I herby certify that I have this day personally examined the above car; that there are no holes or cracks in the roof, sides, ends or car lining; that the floor is clean and in good condition, and it and the car lining are free of nails and uncovered pieces of projecting metal; that I have examined all the journal boxes and they are properly packed, oiled and covered; and that the air brakes and hand brakes are in good condition for service.

. . . . . .

Railway employee inspecting car

Section 2

Station . . . . . Date . . . . . .

I herby certify that I have this day personally examined the above car; that the explosives in or on this car have been loaded, blocked and braced according to the regulations prescribed by the Canadian Transport Commission; that required placards have been applied to the car; and that the doors fit or have been stripped so that sparks cannot enter.

. . . . . .

Shipper's authorized agent

. . . . . .

Railway employee inspecting load

Section 3

Railway . . . Station. . . . . Date . . . . . .

I herby certify that I have this day personally supervised the loading of the above unit on Car No. . . . . and its securement to that car.

. . . . . .

Shipper or railway employee inspecting loading onto railcar

(b) Car certificates remaining on hand and which were authorized by regulations in effect prior to July 1, 1985 may be used until stocks are exhausted.

§ 74.527 Forbidden mixed loading and storage. (a) Division 1.1 or division 1.2 explosives and initiating or priming explosives must not be transported together in the same rail car. Additionally, they must not be transported, loaded, or stored on carrier property with charged electric storage batteries or with any goods, flammable liquid, flammmable solid, flammable gas, oxidizer, organic peroxide, non-flammable gas, corrosive, poison gas or radioactive goods.

§ 74.528 Protect explosives from injury. (a) In a car containing explosives, the explosives and all other freight must be so loaded, and if necessary so braced and stayed, as to prevent injury to packages of explosives during transit.

(b) Shipments of division 1.1 or division 1.2 Explosives.

(1) In this paragraph, "Securing device" means a securing device approved by the Railway Transport Committee."

(2) In accordance with the procedure set out in subsection (3) carriers shall implement a surveillance program of shipments of division 1.1 or division 1.2 explosives; such program shall include the examination and recording of car seals and securing devices at interchange points, or at points where interchange inspections are normally made by railway constables, and at terminals where railway constables are stationed. Carriers without constable forces shall make provisions for examination and recording car seals and/or securing device numbers at interchange points and terminals. The Director of Operation, R.T.C. and appropriate police force (local, provincial or R.C.M.P., as the case may be), shall be notified by the carrier responsible for the carriage of the shipments when such shipments are set off at any intermediate points and at destination.

(3) The carrier shall not accept for transport any shipments of division 1.1 or 1.2 explosives unless

(i) the shipper has secured the doors with an approved securing device approved by the Railway Transport Committee in addition to conventional seals, and

(ii) the shipper has stipulated division 1.1 or division 1.2 explosives on its billing and has notified the carrier accordingly.

(c) The carrier shall report immediately by telephone to the Director of Operation, R.T.C., any theft of division 1.1 or 1.2 explosives or by phone or wire any irregularity (including train unable to proceed) in connection with shipments of such explosives. A telephone report is to be confirmed by telegram or mail.

§ 74.529 Cars for division 1.3 explosives. (a) Explosives, division 1.3, must not be loaded, transported, or stored in cars equipped with any type of lighted heater or open-flame device, or in cars equipped with any apparatus or mechanism utilizing an internal combustion engine in its operation.

(b) Shipments of division 1.3 explosives must be loaded in a closed car or container car which is in good condition, into which sparks cannot enter, and with roof not in danger of tak-

ing fire through unprotected decayed wood. These cars do not require the car certificate. The doors if not tight must be stripped to prevent entrance of sparks.

(c) Explosives, division 1.3, may be carried in tight, closed truck bodies or trailers on flat cars provided all automatic heating or refrigerating machinery with which truck bodies or trailers are equipped shall be rendered inoperative.

§ 74.530 Cars for division 1.4, explosives. (a) Explosives may be loaded into any closed car in good condition. With the exception of blasting caps and electric blasting caps, explosives division 1.4, may be loaded into any container car in good condition. No car certificates are required.

(b) Explosives, division 1.4, may be carried in tight closed truck bodies or trailers on flat cars provided all automatic heating or refrigerating machinery with which truck bodies are equipped shall be rendered inoperative.

§ 74.532 Loading of other dangerous goods. (a)Before acceptance by carriers, shipments shall be properly loaded in closed cars, containers, tight closed truck bodies or trailers on flat cars, except as otherwise provided in these regulations.

(1) Shippers must furnish the material for staying packages of other dangerous commodities loaded by them.

Flammable liquids or flammable gases must not be loaded, transported or stored in cars equipped with any type of lighted heater or open-flame device, or in cars equipped with any apparatus or mechanism utilizing an internal combustion engine in its operation.

(1) Flammable liquids or flammable gases must not be loaded in truck bodies or trailers equipped with lighted heaters or any automatic heating or refrigerating apparatus when such truck bodies or trailers are loaded on flatcars.

(2) This prohibition does not apply and heating or refrigeration apparatus may be operated on insulated box cars or on motor vehicles loaded on flat cars when such cars or motor vehicles are loaded with flammable liquids or flammable gases, when the lading space is equipped with no electrical apparatus other than nonsparking or explosion-proof types, no combustion apparatus in the lading space, and no connection for return air from the lading space to any combustion apparatus. The heating system must be such that no part of the lading is heated to a temperature in excess of 130°F. (54.4°C)

(3) Pyroforic liquids in cylinders. Cylinders containing pyroforic liquids, n.o.s., unless packed in strong wooden boxes and secured therin to protect valves and safety relief devices in the vapour space, and must be secured so that no shifting will occur in transit.

(c) Packages must be loaded so they cannot fall and other packages cannot fall onto or slide against them. This requirement does not preclude the use of loading methods that are designed to permit limited movement of the load and that are approved in writing by the Commission. Packages bearing markings "THIS SIDE UP" or "THIS END UP" or equivalent markings must be so loaded. Packages of flammable solids or oxidizing substances must not be loaded in the same end of a car with packages of corrosive liquids, except that the shippers loading carload shipments who have obtained prior approval from the Commission, may load materials together when it is known that the mixture of contents would not cause a dangerous evolution of heat or gas.

(d) Metal barrels or drums containing flammable liquids may be loaded on steel gondola or flat cars or into stock cars, but must not be loaded into hopper bottom cars.

(e) Empty cylinders, barrels, kegs, or drums, previously used for the shipment of any dangerous commodity must have all openings including removable heads, filling and vent holes properly closed before being offered for transportation. Small quantities of the material with which containers were loaded may remain in containers and when the vapors remaining therein are unstable, it is permissible to add sufficient inert gas to render the vapours stable.

(f) Carboys previously used for the shipment of corrosive liquids when presented to carriers for transportation in carload or less-than-carload shipments as "empty" carboys, must be thoroughly (completely) drained.

(g) Matches. Carload lots of strike-anywhere (friction) matches must be loaded as compactly as possible to avoid motion within the car, especially lengthwise of the car. Protruding nails, metal band anchors or other projections on sidewalls, ends, door posts, studding, or car floors liable to puncture packages must be removed or adequately covered to prevent damage to containers of matches.

(2) Carload lots of strike-anywhere matches handled subject to stop off privileges must be loaded in accordance with paragraph (g) of this section and when necessary the load must be rearranged and/or blocked and braced by each consignee before forwarding.

(3) Less-than-carload lots of "strike-anywhere" matches should be carefully loaded so that they cannot fall and so that other packages of freight cannot fall on or injure them.

(4) Carload or less-than-carload lots of "strike-anywhere" matches which have been damaged by fire, or by water in extinguishing a fire, in transit or on carrier's property, must be reloaded in properly prepared cars, and braced or blocked before being forwarded to destination, to freight claim department or claim adjusters, or to original shipper or other parties for salvage. Great care should be taken to examine and repair damaged to outside packages before reloading into car. All loose matches should first be destroyed. Individual interior boxes and paper-wrapped cartons or packages, should then be carefully placed in tight outside packages complying, as nearly as circumstances will permit, with container specifications; but under no condition shall the outside package be of less strength than required by specification 15A or 12C, nor of greater capacity than authorized. Charred cases must not be used. Boards used in repairing wooden cases must be so nailed that they will not allow any interior boxes, cartons, or packages to fall out. In the event that the individual boxes or paper-wrapped packages do not fit snugly in the outside package, the vacant spaces should be filled tightly with dry and clean cotton waste, or elastic wads of dry newspapers or dry waste paper.

(h) Corrosive liquids: Carboys of corrosive liquids must not be loaded into container cars. They must be so blocked, braced, or stayed that they cannot change position during transit when being handled with reasonable care. Carboys of nitric acid must not be loaded into box cars or in truck bodies or trailers on flat cars more than two tiers high, except that completely boxed carboys, specification 1D, may be loaded three tiers high. Car doors may be cleated in an open position if desired. Flat or stock cars may be used for loading carboys of acids.

(1) When less-than-carload shipments are loaded with other freight, the carboys must be placed near the doorway and must

have wooden strips not less than 2 inches in height nailed to the car floor about 8 inches from the bracing. These strips must be arranged so that the liquid from a broken carboy will drain toward the doorway and outside the car. The space between the strips and the floor braces or blocking used for staying the carboy boxes must be covered with at least 1 inch thickness of clean and dry sand or earth, not sawdust or other combustible material.

(2) Nitric acid, when loaded with other acids or other corrosive liquids in carboys, must be separated from the other carboys. A 2 by 6 inch plank, set on edge, should be nailed across the car floor at least 12 inches from the nitric acid carboys and the space between the plank and the carboys of nitric acid should be filled with sand, sifted ashes, or other incombustible absorbent material.

(3) Electric storage batteries (wet) for shipment must be completely protected so that short circuits will be prevented and must not be loaded or stored with explosives.

(i) Compressed gases in cylinders: Cylinders containing compressed gases shall be securely lashed in an upright position so as to prevent their overturning; or loaded into racks securely attached to the car; or packed in boxes or crates of such dimensions as to prevent their overturning; or loaded in a horizontal position. Spec. 4L cylinders must be loaded in an upright position and be securely braced.

(1) Cylinders containing compressed gases may be loaded into steel gondola or flat cars or into stock cars, but must not be loaded into hopper bottom cars.

(j) Radioactive material.

(3) Containers of radioactive material and/or manufactured articles containing radioactive material, which because of their weight, size, or design make them impracticable to load in a closed freight car, may be loaded on flat cars or in gondola cars (drop-bottom cars not authorized).

(4) No persons shall remain in a car containing radioactive material unnecessarily and the shipper must furnish the carrier with such information and equipment as is necessary for the protection of the carrier's employees.

(5) Any loose radioactive material must be removed from the car and placed in a closed container in a segregated location and held for instructions from the shipper or the Director of Operation, Railway Transport Committee of the Commission.

(k) Nitrates, except ammonium nitrate having organic coating, listed in § 73.182 (b) must be loaded in clean closed cars, which shall be free of loose boards, cracks, holes, or exposed decayed spots. Interior of cars must be swept clean and be free of any projections capable of injuring bags when so packaged. Ammonium nitrate or ammonium nitrate fertilizer, division 5.1, ammonium nitrate mixed fertilizer, or ammonium nitrate-phosphate, in bulk may be loaded in clean covered hopper cars. Journals and boxes must be in good condition.

(l) Poisonous gases, requiring a square background to the placard may be shipped by, for or to the Department of National Defence if loaded and handled as follows:

(1) In metal drums, specification 5A, in box cars, gondola cars (flat bottom), or stock cars, in carload lots.

(2) In tanks, specification 106A, mounted on or secured to multi-unit cars or gondola cars (flat bottom) in carload lots only.

(3) In bombs, in box cars or gondola cars (flat bottom) in carload lots only.

(4) In projectiles or ammunition for cannon with gas filled projectiles in box cars in carload or less-than-carload lots.

(5) Gas handlers. Each shipment of one or more carloads as described in subparagraphs (1), (2), (3), and (4) of this paragraph, shall be accompanied by a crew of qualified gas handlers, supplied with equipment to handle leaks or other container failure, which will permit the escape of gas. Gas handlers will remain with the shipment during the entire time that it is in the custody of the carrier. Gas handlers will in the event of leakage or escape of gas, make repairs and perform decontamination, if necessary. If they need assistance they will advice the carrier's representative and the Commission.

(6) Loading and bracing in cars. Drums must be loaded in cars having level floors. Cars equipped with metal corrugated ends or cars having bowed ends must be supplied with end wall bulkheads constructed in accordance with requirements for centre gates. (See Sketch 1, Bureau of Explosives' Pamphlet No. 6.)

(7) Drums must be loaded not more than one tier (layer) high and with filling holes up. They must be loaded as closely together as possible both crosswise and lengthwise and so blocked and braced as to maintain their relative positions during transit.

(8) Drums with filling holes in heads must be loaded on their bottoms. They may be loaded in rows, lengthwise of the car and any space between the sides of car and the nearest row of drums must be "filled in" with wooden boards or lumber nailed to sides of car sufficient in length and width to contact both hoops of drums, or, drums may be loaded across car in staggered stacks of which the number of drums in alternate stacks is reduced by one drum. All drums in stacks following the first stack loaded in end of car must be placed tightly into the angle of space formed by the side walls of the drum in the preceding stack. Any space between the sides of car and the drums in stacks having the greater number of drums must be "filled in" with wooden boards or lumber nailed to sides of car sufficient in length and width to contact both hoops of drums.

(9) Drums with filling holes in sides must be loaded on their sides with filling holes up. They must be loaded lengthwise of the car in rows and any space between the sides of car and the nearest row of drums must be "filled in" with wooden boards or lumber nailed to sides of car sufficient in length and width to contact both hoops and drums.

(10) Drums must be loaded in box car from ends of car toward space between car doors, and there braced by centre gates and wedges. (See Sketch 1, Bureau of Explosives' Pamphlet No. 6.)

(11) Doorways of box cars must be protected by one of the methods prescribed in Sketch 1, Bureau of Explosives' Pamphlet No. 6A.

(12) Tanks must be securely mounted on cars especially provided for them or on gondola cars prepared with substantial wooden frames and blocks.

(13) Bombs, projectiles, and cannon ammunition must be loaded, blocked and braced as shown in Bureau of Explosives' Pamphlet 6A. When shipments are loaded in gondola cars they must be securely blocked and braced and not loaded higher than the sides of the car.

(m) Material marked as or known to be poison (division 2.3 or division 6.1 packaging group I or II) must not be transported in the same car with material which is marked as or known to be foodstuffs, feeds, or any other edible material intended for consumption by humans or animals.

(n) Spec. 56 or 57 portable tanks containing dangerous com-

modities may not be stacked on each other nor may any other freight be stacked on them during transportation.

§ 74.533 Truck bodies or trailers on flat cars. (a) Truck bodies or trailers containing dangerous commodities as provided in these Regulations must be of such design and so loaded that they will not rupture or become seriously damaged under conditions normally incident to transportation and must be so secured on the flat car that they cannot permanently change position during transit. The whole unit (car, container or trailer, and packages) shall comply with the requirements of § 74.501.

(b) Truck bodies or trailers equipped with automatic heating or refrigerating equipment employing any fuel or article classed as a dangerous commodity in these regulations may be loaded and transported on flat cars if such equipment is of a type approved by the Commission. They must be so braced and stayed on the flat car that they cannot permanently change position during transit.

(c) A truck body or trailer on which is mounted any cargo tank containing any dangerous commodity shall not be accepted for transportation or transported except under conditions approved by the Commission.

§ 74.534 Portable containers or cargo tanks. (a) Portable containers or cargo tanks must be of such design and so loaded and stayed in closed cars, in gondola cars, on flat cars, or in truck bodies or trailers on flat cars so that they cannot permanently change position, rupture or become seriously damaged under conditions normally incident to transportation. Ends, side walls or doors of truck bodies or trailers shall not be relied upon to prevent shifting of portable containers or tanks. The whole unit (car, container or tank and packages) shall comply with the requirements of § 74.501.

§ 74.538 Forbidden mixed loading of dangerous goods. (a) Unless otherwise permitted by these regulations, dangerous goods shall not be loaded, transported or stored together in the same packaging or in the same car, container or trailer with other dangerous goods, the mixing of which would be liable to produce a dangerous evolution of heat or gas or of a corrosive material.

SUBPART D—UNLOADING FROM CARS

§ 74.560 Carload shipments and delivery. (a) Carload shipments in bulk of gases of Class 2.1, 2.3, or 2.4, or liquid oxygen, flammable liquids of Class 3.1 or 3.2, oxidizing substances of Class 5.1 or 5.2, poisonous substances, or corrosives must not be offered for transport or transported unless originally consigned or subsequently reconsigned to parties having a private siding (see Note 1 to this section) or to parties using carrier siding equipped for transferring the commodity from cars to permanent storage tanks of sufficient capacity to receive entire contents of the car.

(b)(1) Carload shipments of explosives must not be offered for shipment unless originally consigned or subsequently reconsigned to parties having a private siding (See Note 1 to this section) or to parties using carrier siding facilities which have been approved by the Committee for explosives unloading.

(1) Any tank car of ICC-106A or 110A type may be delivered and the loaded unit tanks may be removed from car frame on carrier tracks, if, before car is accepted for transportation, the shipper has obtained from the delivering carrier and filed with originating carrrier, written permission (see Note 2 to subparagraph (2) of this paragraph) for such removal. The consignee must furnish adequately safe mechanical hoist, obtained from the carrier if desirable, by which the tanks are lifted from the car and deposited directly upon vehicles furnished by the consignee for immediate removal from carrier property or tanks must be lifted by adequately safe mechanical hoist from car directly to vessels for further transportation.

(2) Any tank car tank other than a 106 or 110 type containing anhydrous ammonia, liquefied hydrocarbon or liquefied petroleum gas, and having the interior pipes of liquid and gas discharge valves equipped with check valves, may be delivered and unloaded on carrier tracks, if the lading is piped directly from the car to permanent storage tanks of sufficient capacity to receive the entire contents of the car.

NOTE 1: For this purpose, a private track is a track outside of carrier's right-of-way, yard and terminals which is devoted exclusively to the purpose of its user.

NOTE 2: Carriers should give permission for the unloading of these containers on carrier tracks only where no private siding is available within reasonable trucking distance of final destination. The danger involved is the release of compressed gases due to accidental injury to container in handling. The exposure to this danger decreases directly with the isolation of the unloading point.

(f) No commodity described in paragraph (a) of this section shall be transferred from a permanent storage tank or a tank car on carrier property to a temporary storage tank, motor vehicle, drum or cylinder except with the approval of the Director of Operation, R.T.C.

(g) Tank car back-filling. Tank cars which have been unloaded and back-filled with natural gas or methane (UN 1971) shall not be offered for transport unless one of the following conditions is met:

(1)(i) the internal pressure of the tank car has been certified by the shipper not to exceed 25 pounds per square inch,

(ii) all documentation pertaining to the tank cars specifies:

'car back-filled with natural gas, Flammable Gas, Division 1, Class 2, placarded; last contained _____',

(iii) the tank car is placarded as required and carries the United Nations number 1971.

(2)(i) The internal pressure of the tank car has been certified by the shipper not to exceed 150 psi,

(ii) the tank car is offered, handled for transportation and transported as a full load of natural gas, and

(iii) all documentation pertaining to the tank car specifies: "car back-filled with natural gas, Flammable Gas, Division 1, Class 2; in excess of 25 psi; placarded; last contained _____."

§ 74.561 Tank car loading and unloading. (a) In loading or unloading tank cars the following rules must be observed.

(1) Unloading and loading operations shall be performed only by reliable persons properly instructed and made responsible for careful compliance with this part.

(2) Brakes must be set and wheels blocked on all cars being loaded or unloaded.

(3) Caution signs must be so placed on the track or car as to give necessary warning to persons approaching car from open end or ends of siding and must be left up until after car is loaded or unloaded and disconnected from discharge connection. Signs must be of metal or other suitable material, at least 12 by 15 inches in size and bear the words "STOP—Tank Car Connected," or "STOP—Men at Work," the word "STOP" being in

letters at least 4 inches high and the other words in letters at least 2 inches high. The letters must be white on a blue background.

NOTE 1: In addition to the stop signs described in (3), Chlorine cars must be protected during unloading by locked derails or switches located at least one car length from the car being unloaded on the open end or ends of the unloading track.

(4) Before manhole cover or outlet valve cap is removed, tank car must be relieved of all interior pressure by cooling tank with water or venting tank by raising safety valve or opening vent on dome at short intervals. If venting to relieve pressure will cause a dangerous amount of vapor to collect outside the car, venting must be deferred until pressure is reduced by allowing the car to stand overnight or otherwise cooling the contents. These precautions are not necessary when car is equipped with a manhole cover which hinges inward or with an inner manhole cover which does not have to be removed to unload the car, and when pressure is relieved by piping vapor into a condenser or storage tank.

(b) After pressure is released, seal should be broken and manhole cover removed as follows:

(1) Screw type. Cover must be loosened by placing bar between manhole cover lug and knob. After two complete turns, so that vent openings are exposed, the operation must be stopped, and if there is any sound of escaping vapor, the cover must be again screwed down tightly and interior pressure relieved as prescribed in paragraph (a) (4) of this section, before again attempting to remove the cover.

(2) Hinged and bolted type. All nuts must be unscrewed one complete turn, after which same precautions as prescribed for screw type cover must be observed.

(3) Interior type. All dirt and cinders must be carefully removed from around cover before yoke is unscrewed.

(c) When car is unloaded through bottom outlet valve, manhole cover must be adjusted as follows:

(1)Screw type. Manhole cover must be put in place, but not entirely screwed down, in order that air may enter tank through vent holes in threaded flange of cover.

(2) Hinged and bolted type. A small wooden block should be placed under one edge of cover.

(3) Interior type. Screw must be tightened up in yoke so that cover will be brought up within one-half inch of closed position.

(d) When unloading through bottom outlet of cars equipped with interior manhole type of covers, and in all cases where unloading is done through the manhole (unless special covers are used, provided with safety-vent opening and tight connection for discharge outlet), the manhole must be protected against entrance of sparks or other sources of ignition of vapor by asbestos or metal covers or by being covered and surrounded with wet burlap. Burlap must be kept damp by replacement or the application of water as needed.

(e) Seals or other substances must not be thrown into the tank. Also care must be taken to avoid spilling any of the contents over car or tank.

(f) Valve rod handle or control in dome must be operated a few times to see that outlet valve in bottom of tank is on its seat before valve cap is removed.

(g) Valve cap, or reducer when large outlet is to be used, must be removed with suitable wrench after set screws are loosened and a pail is placed in position to catch any liquid that may be in outlet chamber. If valve cap or reducer does not unscrew easily, it must be tapped lightly with mallet or wooden block in an upward direction. If leakage shows upon starting the removal, cap or reducer must not be entirely unscrewed, but sufficient threads must be left engaged and sufficient time allowed to permit escape of any accumulation of liquid in the outlet chamber. If leakage stops or initial rate of leakage diminishes materially, cap or reducer may be entirely removed. If initial rate of leakage continues, further efforts must be made to seat the outlet valve, see paragraph (f) of this section. If this fails, the cap or reducer must be screwed up tight and tank must be unloaded through the dome. If upon removal of the outlet cap the outlet chamber is found to be blocked with frozen liquid or any other matter, replace cap immediately and make careful examination to determine that outlet casting has not been cracked. If the obstruction is not frozen liquid, the car must be unloaded through the dome. If the obstruction is frozen liquid and no crack has been found in the outlet casting, the car may, if circumstances require it, be unloaded from the bottom, as follows:

(1) Remove cap and attach unloading connections immediately. Then, before opening the valve inside the tank car, apply steam to outside of outlet casting or wrap casting with burlap or other rags and apply hot water to melt the frozen liquid. In any event, top unloading is considered safer than bottom unloading.

(h) Unloading connections must be securely attached to unloading pipes on dome or to bottom discharge outlets before discharge valves are opened.

(i) Tank cars must not be allowed to stand with connections attached after loading or unloading is completed, and throughout the entire period of loading or unloading, or while car is connected to unloading device, the car must be attended by the loader or unloader.

(j) If necessary to discontinue loading or unloading a tank car for any reason, all connections must be disconnected. All valves must first be tightly closed, and the closures of all other openings securely applied.

(k) As soon as a tank car is completely loaded or unloaded, all valves must be made tight, the connection must be removed and all other closures made tight, except that after unloading heater coil inlet and outlet pipes must be left open for drainage. The manhole cover must be applied by the use of a bar or wrench, the outlet valves reducer and outlet valve cap by the use of a wrench having a handle at lest 36 inches long, and the outlet valve cap plug, end plug, and all other closures of openings and of their protective housings by the use of a suitable tool.

(l) Railroad defect cards must not be removed.

(m) Ground around connections must be covered with fresh, dry sand or dirt, if oil or gasoline has been spilled previously.

(n) All tools and implements used in connection with unloading should be kept free from oil, dirt, and grit.

NOTE 1: In addition to the general regulations of § 74.561, special unloading procedures: such as those suggested by the Chlorine Institute of 342 Madison Ave., New York 17, the Agricultural Ammonia Institute of Memphis, Tenn., and the Compressed Gas Association are recommended to all persons concerned with the safe handling of dangerous commodities by tank car.

§ 74.566 Cleaning cars. (a) Cars which have contained dangerous commodities, which show any evidence of leakage from packages, must be thoroughly cleaned after unloading before cars are again placed in service.

(1) Any car which has been used to transport any poisonous liquid or solid, division 6.1, shall be inspected for contamination

before reuse. In instances where leakage or spillage has occured, the Director of Operation, R.T.C., and the shipper of the material shall be immediately notified for instructions concerning the best method to be employed for the removal of the contamination. Cars which have been contaminated must not be returned to service until the contamination has been removed. this subparagraph does not apply to any car used solely for transporting poisonous liquids or solids, division 6.1 so long as it is used for that purpose.

(b) After unloading poisons or potassium permanganate from steel hopper cars or other cars, cars must be thoroughly flushed out with water except that cars used exclusively in this service under the provisions of §§ 73.194 (a) and 73.368 (a) shall not be subject to this requirement.

(c) All loose powder or other explosive or any other dangerous article which has leaked from packages must be carefully removed from car and other railroad property.

(d) Cars contaminated with radioactive material:

(1)Each car used for transporting low specific activity material by full load shipment must be surveyed with appropriate radiation detection instruments after each use. Carriers must not return such cars to service until the radiation dose rate at any accessible surface is not more than 0.5 millirem per hour, and there is no significant removable radioactive surface contamination.

(2) This paragraph does not apply to any car used solely for the full load shipment of radioactive material if a survey of the interior surface shows that the radiation dose rate does not exceed 10 millirem per hour at the interior surface or 2 millirem per hour at 1 metre (39 inches) from any interior surface. These cars must be stencilled with the words "FOR RADIOACTIVE MATERIAL USE ONLY" in lettering at least three inches high in a conspicuous place on both sides of the exterior of the car. These cars must be kept closed at all times other than loading and unloading.

§ 74.567 Flammable vapours. (a) Any box car or container known to contain flammable liquids, gases or vapours must not be entered with a lighted open-flame lantern or torch, or other source of fire, until both car doors have been opened and sufficient time allowed for ventilation and escape of any vapours.

§ 74.568 Forbidden Explosive Unloading Sites. (a) Carriers shall not load or unload or permit to be loaded or unloaded explosives in Divisions 1 and 2 of Class 1, into or from railway vehicles at the following locations:

(1) Canadian National Railways, Symington Yard, Winnipeg, Manitoba

(2) Canadian National Railways, mileage 76.8, near Arnold, British Columbia.

(3) Canadian National Railways, Cowichan Tyup Siding, mileage 5.0, near Duncan, British Columbia.

(4) Canadian National Railways, siding, mileage 132.0 Grande Prairie Subdivision, near Pouce Coupé, British Columbia.

(5) Canadian National Railways, mileage 7.09, Tilbury Island Branch, Brownsville, British Columbia.

(6) Canadian National Railways, mileage 8.9, St. John's Subdivision, Irvin, Newfoundland.

SUBPART E—HANDLING OF CARS BY CARRIERS

§ 74.575 Restrictions. (a) When local conditions make the acceptance, transportation, or delivery of commodities hazardous, local restrictions may be imposed by the carrier.

(b) All carriers must report to the Commission, for publication, full information as to restrictions which may be imposed against the acceptance, delivery, or transportation of dangerous commodities, over any portion of their lines.

§ 74.578 Flammable vapors. (a) A box car or container car placarded flammable liquid, division 3.1 or 3.2 or known to contain flammable liquids, must not be entered with a lighted open-flame lantern, torch, or other fire, until both car doors have been opened and sufficient time allowed for ventilation and escape of any vapors.

§ 74.580 Violations must be corrected. (a) All violations discovered must be corrected before forwarding shipments.

§ 74.581 Routing shipments. (a) Before any shipment of explosives, division 1.1 or division 1.2, destined to a point beyond the lines of the initial carrier, is accepted from a shipper, the initial carrier must ascertain that the shipment can go forward by the route designated, and to avoid delays en route the initial carrier must be in possession of full rate information, before forwarding the shipment.

§ 74.582 Movement to be expedited. (a) Carriers must forward shipments of dangerous commodities promptly and within 48 hours, Saturdays, Sundays, and holidays excluded after acceptance at originating point or receipt at any yard, transfer station, or interchange point, except that where bi-weekly or weekly service only is performed, shipments of dangerous commodities must be forwarded on the first available train.

(b) No car shall be received and held at any point so as to defeat the purpose of this section or of § 74.560.

§ 74.589 Handling cars. (a) Definitions. (1) "Person" means any individual, partnership, corporation, association, joint stock company, business trust or other organized group of persons, or any trustee, receiver, assignee, or personal representative, and includes any department or agency of the Government of Canada, any Province, or any other political, governmental or legal entity;

(2) "Railroad" means any person engaged in transportation as a common carrier by rail and includes its agent or employees;

(3) "Engine" means any locomotive, propelled by any form of energy, used by a railroad;

(4) "Freight car" means any vehicle used for the transportation of property by rail;

(5) "Passenger car" means any vehicle used for the transportation of passengers by rail;

(6) "Combination car" means any vehicle used for the transportation of both property and passengers by rail;

(7) "Occupied caboose" means any vehicle used by railroad employees, caretakers, or other authorized to ride therein;

(8) "A train" is one or more engines coupled together with or without cars displaying markers;

(9) "Freight train" means one or more engines coupled with one or more freight cars, displaying markers;

(10) "Passenger train" means one or more engines coupled with one or more passenger cars carrying passengers, displaying markers;

(11) "Mixed train" means one or more engines coupled with one or more freight cars and passenger cars carrying passengers, displaying markers;

(b) Placards on cars.

(1) Cars, containers and trailers requiring car certificates pursuant to § 74.525 (d) and placards pursuant to the Transportation of Dangerous Goods Regulations shall not be transported unless they are at all times placarded and certified as required. Placards and car certificates lost in transit shall be replaced at the next inspection point, and those not required shall be removed at the next terminal where the train is classified.

(2) At points where trains are inspected, cars placarded with a placard with a square background and adjacent cars shall be inspected. Such cars shall continue in transit only when inspection shows them to be in condition for safe transportation.

(c) Switching of cars containing dangerous commodities.

(1) In switching operations where the use of hand brakes is necessary, a loaded, placarded tank car, or a draft which includes a loaded, placarded tank car shall not be cut off until the preceding car or cars clear the ladder track, and the draft containing the loaded, placarded tank car, or a loaded, placarded tank car, shall in turn clear the ladder before another car is allowed to follow. In switching operations where hand brakes are used, it must be determined by trial whether a loaded, placarded car, or a car occupied by a rider in a draft containing a placarded car has its hand brakes in proper working condition before it is cut off.

(2) No car bearing a placard with a square background shall be cut off while in motion or coupled into with more force than is necessary to complete the coupling. No car moving under its own momentum shall be allowed to strike any car placarded with a placard with a square background.

(3) When transporting a car placarded with a placard with a square background in a terminal, or yard, or on a side track or siding, the car shall be separated from the engine by at least one non-placarded car.

(4) The doors of each closed car placarded with a placard with a square background shall be closed, securely fastened, and the lading securely braced before the car is moved.

(5) A placarded flatcar or a flatcar carrying a placarded trailer or freight container shall not be cut off while in motion.

(6) No rail car moving under its own momentum shall be permitted to strike any placarded flatcar or any flatcar carrying a placarded trailer or freight container.

(7) No placarded flatcar or flatcar carrying a placarded trailer or freight container shall be coupled into with more force than is necessary to complete the coupling.

(8) No spec. 112 or 114 tank car shall be coupled with any other car at a relative coupling speed in excess of four miles per hour, unless

(i) the tank is empty, and

(ii) the tank has been cleaned and purged.

(d) Placement of freight cars placarded with a placard with a square background in yards, on sidings, or side tracks. A rail car placarded with a placard with a square background shall be placed while in a yard, on a siding or side track so that it will be safe from all probable danger of fire. A car so placarded shall not be placed under a bridge or overhead highway crossing, nor in or alongside a passenger shed or station.

(e) Notice to train crews of placarded cars.

(1) Train crews shall have in their possession a document indicating the position in the train of each loaded placarded car containing dangerous commodities, except when the position is changed or the placarded car is placed in the train by a member of the train crew. A train consist may be used to meet this requirement.

(2) One member of a train crew of a train transporting dangerous commodities shall have in his possession a copy of all Emergency Response Forms required pursuant to § 73.429.

(f) Position of cars in trains. A car carrying dangerous goods shall not be marshalled next to a car described in a column other than column 3 or 4 of the table shown on page 173 if an X appears in that column on the line corresponding to type of car carrying the dangerous goods (as described in column 1) and the placard groups of the dangerous goods (as indicated in column 2).

§ 74.590 Record of change of seals of cars of explosives to be made. (a) When a car seal is changed on a car containing division 1.1 or 1.2 explosives while en route or before delivery to a consignee a record must be made showing the following information which shall be shown on or attached to waybill or other document which shall accompany car to destination.

Railroad Place Date

Car initials Car number

Number or description of seal broken

Number or description of seal used to reseal car

Reasons for opening car

Conditions of load

Name and occupation of person opening car

§ 74.591 Car magazines. (a) When authorized by the Committee, division 1.1 and division 1.2 explosives in quantity not exceeding 150 pounds may be carried in construction or repair cars when the packages of explosives are placed in a "magazine" box made of sound lumber not less than 1 inch thick, covered on the exterior with metal, and provided with strong handles. This box must be plainly stencilled on the top, sides, and ends, in letters not less than 2 inches high, "EXPLOSIVES—DANGEROUS—HANDLE CAREFULLY". The box must be provided with strong hinges and with a lock for keeping it securely closed. Vacant space in the box must be filled with a cushioning material such as sawdust or excelsior, and the box must be properly stayed to prevent movement within the car. The car, when not occupied by a responsible employee, must be placarded "EXPLOSIVES"

POSITION IN FREIGHT OR MIXED TRAIN OF CARS CONTAINING DANGEROUS COMMODITIES

1	2	3	4	5	6	7	8	9	10	11
Type of Car	Placard group no.	When train length permits must not be nearer than 6th from engine, occupied caboose or occupied car	When train length does not permit must be near middle of train but not nearer than 2nd from engine, occupied caboose or occupied car (d)	Open-top car when lading protrudes beyond car or when lading above car end is liable to shift	Loaded flat car (a)	Any car piggyback or container with automatic heating or refrigeration, lighted heater, stoves lanterns or internal combustion engines	Car Placarded			
							Group 1	Group 2	Group 3	Group 4
Any car (includes Flat cars, carrying Trailers, or Containers)	Group 1	X	X	X	X	X		X	X	X
Tank Cars	Group 2	X(b)	X(b)	X	X	X	X	(c)	X	X
Other than Tank Cars	Group 2						X		X	X
Any Car	Group 3	X	X	X	X	X	X	X		X
Any Car	Group 4	X	X				X	X	X	
Tank Car	Group 5	Must not be placed next to engine or occupied caboose								
Any Car	Group 6	NO MARSHALLING REQUIRED								

PLACARD GROUP

1. Group 1 consists of Division 1.1 and 1.2

2. Group 2 consists of Divisions 1.3, 1.4, 1.5, 2.1, 2.2, 2.3, 2.4, 3.1, 3.2, 4.1, 4.2, 4.3, 5.1, 5.2, 6.1, 6.2, and Class 8.

3. Group 3 consists of Cyanogen Chloride, Hydrogen Cyanide, Nitric Oxide, Phosgene, Nitrogen Dioxide, Phosphine, Diborane or Diborane Mixtures, Arsine, Boron Trifluoride, Carbonyl Sulfide, Cyanogen, Nitric Oxide and Nitrogen Tetroxide Mixtures, Nitrogen Oxides n.o.s. and Nitrogen Trioxide.

4. Group 4 consists of Class 7.

5. Group 5 consists of tank cars carrying Division 3.3 flammable liquids or tank cars placarded "RESIDUE" or "EMPTY"

6. Group 6 consists of Class 9, and of Class 6 bearing St. Andrews cross placards.

FOOTNOTES:

(a) Except trailer-on-flat-car, container-on-flat-car, tri-level and bi-level cars and any other car specially equipped with tie down devices for handling vehicles. Permanent end bulk head flat cars considered the same as an open-top car.

(b) Except when train consists only of placarded tank cars.

(c) Tank cars containing flammable gases Division 1 of Class 2 must be separated from tank car shipments of Chlorine, Anhydrous Ammonia and Sulphur Dioxide by 5 cars.

(d) When train length does not permit means not having sufficient buffer cars to provide the 5 car separation.

§ 74.594 Acceptable Emission Limits for Liquefied Petroleum Gas (LPG) Tank Cars. (a) When emission tests conducted in the dome housing of a tank car containing liquefied petroleum gas, in rail transportation, indicate a reading above 10 percent of the lower explosive limit (LEL), as determined by the criteria contained in Appendix A to this Part, the tank car is considered to be leaking and the required repair and reporting procedures must be effected.

§ 74.596 Inspection of rail cars. (a) Placarded cars shall be inspected by the carrier before acceptance at originating points and when received in interchange to see that they are not leaking and that the air and hand brakes, bearings, and trucks are in proper condition for service.

(b) Empty tank cars previously containing a dangerous article tendered for movement or when received in interchange must have manhole covers, outlet valve reducers, outlet valve caps, outlet valve cap plugs, end plugs, and plugs or caps of other openings securely in their proper places; except that heater coil inlet and outlet pipes must be left open for drainage.

(c)Safety valves on tank cars must not be tested while these cars are loaded. Whenever test of safety valves or tank is due on a loaded car while in transit, unless the car is leaking or in a manifestly insecure condition, it must be forwarded to destination, carded on each side with a card exhibiting the following notice: Safety valves

Safety valves
Tank Overdue for test.

Moving under CTC § 74.596 (c).

(1) Prompt reports of such movement, showing initials and numbers of cars, must be made by the railroad carding the cars to the Director of Operations, Railway Transport Committee.

§ 74.597 Railway Gateway Inspection

1. In this section

"census metropolitan area (CMA)" means the area within the boundaries designated by Statistics Canada as the census metropolitan area of each of the urban areas listed in Schedule A;

"Committee" means the Railway Transport Committee of the Canadian Transport Commission;

"full carload lot" means any carload, container or trailer load;

"gateway" means a location on a railway company's right of way situated within a CMA or situated not more than 32.18 kilometres (20 miles) outside the point where it enters a CMA, city or town, that has been approved by the Committee as the appropriate site for inspection or monitoring of a train to ensure it is in safe condition to proceed through the densely populated area of such CMA. city or town;

"hot box and dragging equipment detector" means a heat sensing device installed adjacent to a railway track for indicating the relative temperatures of passing car journal bearings used in conjunction with a mechanism mounted between the rails to detect dragging brake rigging, lading or other car components and enabling the conveyance of this information to a person in charge;

"inspection" means the inspection of cars of a train by qualified employees by means of pull-by or walk-by inspection, or by a combination of a pull-by and walk-by inspection,

(a) at a gateway, or

(b) a location other than one where a company's car inspection forces are assigned or

(c) at successive intervals not exceeding 32.18 kilometres (20 miles) relative to the location of the gateway.

"monitor" means the monitoring of the incidence and location in the train of overheated journal bearings and dragging equipment by means of a hotbox and dragging equipment detector;

"person in charge" means a qualified person appointed by a railway company to ensure the safe and proper conduct of an operation or of the work of employees;

"population" means the number of inhabitants of a given area as shown in the latest quinquennial census of population conducted by Statistics Canada;

"pull-by inspection" means an examination of the cars in a train while the train is in motion at a speed not exceeding 8.04 kilometres (5 miles) per hour;

"qualified employees" means company officers, members of a train crew, or members of a railway company's car inspection forces who have received instruction and demonstrated their capability in the performance of inspections;

"shipping paper" means a waybill, bill of lading, shipping document or Emergency Response Form;

"special dangerous commodity" means a commodity designated by the letter "S" in column 1 of the table to section 72.5.

"speed change point" means a location on a railway company's right of way, situated within, or adjacent to the boundaries of a CMA, city, or town, that has been approved by the Committee as the appropriate site for a reduction in train speed to not more than 56.13 kilometres (35 miles) per hour before the train proceeds through the densely populated area of such CMA, city or town, in order to alleviate the consequences of a derailment should one occur;

"walk-by inspection" means an examination of the cars in a train while the train is stationary.

Application

2. A railway company shall not operate a train carrying one or more full carload lots of special dangerous commodities except in accordance with these Regulations.

Gateways

3. (1) Every railway company shall indentify by mileage location the gateways of CMAs, cities and towns on its lines of railway on which special dangerous commodities are transported, in accordance with the criteria in paragraph 4, and shall file these with the Committee for approval.

(2) Where it is demonstrated by a railway company that a gateway may safely be located at a point within the boundary of a CMA, city or town because the densely populated area adjacent to the track does not extend to the boundary, the Committee may approve the location of a gateway within such a boundary.

(3) No change shall be made in the list of gateways approved pursuant to subparagraph (1) without the approval of the Committee.

(4) Each railway company shall perform the inspections or monitoring required pursuant to paragraph 4 at locations within one mile of the gateways approved by the Committee pursuant to this section.

Inspection and Monitoring of Trains

4. (1) Trains carrying one or more full carload lots of any special dangerous commodity shall receive an inspection or be monitored at,

(a) the gateway to a CMA, and

(b) subject to paragraph 9, at intervals not exceeding 32.18 kilometres (20 miles) from that gateway while within a CMA or until the train reaches the speed change point which is allocated to trains moving in the opposing direction on the same or adjacent tracks.

(2) Subject to subparagraph 9 (b), trains or transfer movements carrying one or more full carload lots of any special dangerous commodity which are made up within a CMA at locations other than those where a company's car inspection forces are assigned, shall be inspected before departure from the location at which they are made up, and at subsequent intervals not exceeding 32.18 kilometres (20 miles) shall be inspected or monitored while the train or transfer movement remains within the CMA or until it reaches the speed change point which is allocated to trains moving in the opposing direction on the same or adjacent tracks.

(3)Effective October 1, 1984 trains carrying one or more full carload lots of any special dangerous commodity shall receive an inspection or be monitored at the gateway to a city or town having a population of between 50,000 and 100,000 unless that city or town lies within a CMA.

(4) Effective October 1, 1987 trains carrying one or more full carload lots of any special dangerous commodity shall receive an inspection or be monitored at the gateway to a city or town having a population of between 10,000 and 50,000 unless

(a) that city or town lies within a CMA or

(b) the train speed does not exceed 56.13 kilometers (35 miles) per hour pursuant to subparagraph 12(1).

5. (1) The inspections required pursuant to paragraph 4 shall be performed by qualified employees.

(2) The inspections shall cover that portion of the train from the front up to and including the second car behind the last full carload of any special dangerous commodity.

(3) Qualified employees performing an inspection shall look for the following defects:

(a) journal bearing or wheel overheating as evidenced by colour, flame, smoke, odour or sound;

(b) wheels which are loose, broken or have flat spots;

(c) dragging brake rigging, securement devices or lading;

(d) abnormal car movement;

(e) misplaced car components or assemblies;

(f) shifted lading, and

(g) any other unsafe conditions readily detectable by such an inspection.

6. The monitoring required pursuant to paragraph 4 shall be performed by means of a hotbox and dragging equipment detector of a type acceptable to the Committee.

7. When a defect is found, by inspection or by monitoring, that may affect the safe operation of the train, the person in charge shall take the appropriate action to eliminate or minimize any potential danger by means of one or more of the following methods:

(a) correction of the defect,

(b) reduction of train speed,

(c) removal of the defective car from the train, or

(d) the taking of such other action as is necessary to ensure the continued safe operation of the train.

Speed of Trains

8. (a)Every railway company shall identify by mileage location the speed change points for CMAs, cities and town on its lines of railway on which special dangerous commodities are transported in accordance with the criteria established in paragraphs 9, 10, 11 and 12 and shall file these with the Committee for approval.

(b) No change shall be made in the list of speed change points approved pursuant to this section without the approval of the Committee.

9. (a) The inspection or monitoring of a train required pursuant to subsubparagraph 4(1)(b) may be omitted provided that the train travels at a speed of not more than 24.13 kilometres (15 miles) per hour beyond the inspection point until it has either completed its trip within this CMA, or has reached, on its outbound movement from this CMA, the speed change point which is allocated to trains moving in the opposing direction on the same or adjacent tracks.

(b) In lieu of the inspection or monitoring described in subparagraph 4(2) the train shall proceed at not more than 24.13 kilometres (15 miles) per hour from the point within the CMA at which inspection or monitoring is required until it reaches the speed change point which is allocated to trains moving in the opposing direction on the same or adjacent tracks.

10. (a) No train carrying one or more full carload lots of any special dangerous commodity shall travel at more than 56.13 kilometres (35 miles) per hour after reaching the speed change point in or adjacent to a CMA until it has either completed its trip within the CMA, or has reached, on its outbound movement from this CMA, the speed change point which is allocated to trains moving in the opposing direction on the same or adjacent tracks.

11. (1) Subject to subparagraph (2) no train carrying one or more full carload lots of any special dangerous commodity shall travel at more than 56.13 kilometres (35 miles) per hour after reaching the speed change point in or adjacent to a city or town with a population of between 50,000 and 100,000 until it has either completed its trip within the city or town, or has reached, on its outbound movement from the city or town, the speed change point which is allocated to trains moving in the opposing direction on the same or adjacent tracks, unless the train is monitored or receives

an inspection at the inbound gateway.

(2) Sub paragraph (1) does not apply to cities or towns with a population of 50,000 to 100,000 which lie within a CMA.

12. (1) Subject to subparagraph (2) after October 1, 1987 no train carrying one or more full carload lots of any special dangerous commodity shall travel at more than 56.13 kilometres (35 miles) per hour after reaching the speed change point in or adjacent to a city or town with a population of between 10,000 and 50,000 until it has either completed its trip within the city or town, or has reached, on its outbound movement from the city or town, the speed change point which is allocated to trains moving in the opposing direction on the same or adjacent tracks, unless the train is monitored or receives an inspection at the inbound gateway.

(2) Subparagraph (1) does not apply to cities or towns with a population of 10,000 to 50,000 which lie within a CMA.

Population Changes

13. Where changes in population as published in the latest quinquennial census of population place a CMA, city or town in a different category with respect to inspection, monitoring or speed change requirements a company shall be allowed a period of grace to comply with such new requirements as follows:

(a) one year for inspection or monitoring,

(b) one month for establishment of the 56.13 kilometres (35 miles) per hour speed restriction and provisional speed change points, and

(c) six months for establishment of speed change points approved by the Committee.

Reporting

14. Every railway company shall provide to the Committee, by not later than the last day of February of each year, a report containing the quantity and locations of hot box and dragging equipment detectors installed during the previous calender year.

SCHEDULE A

CENSUS METROPOLITAN AREAS

St. John's, Newfoundland	London, Ontario
Halifax, Nova Scotia	Windsor, Ontario
Saint John, New Brunswick	Sudbuy, Ontario
Chicoutimi, Quebec	Thunder Bay, Ontario
Quebec, Quebec	Winnipeg, Manitoba
Trois Rivieres, Quebec	Regina, Saskatchewan
Montreal, Quebec	Saskatoon, Saskatchewan
Ottawa/Hull, Ontario/Quebec	Calgary, Alberta
Oshawa, Ontario	Edmonton, Alberta
Toronto, Ontario	Vancouver, Britsh Columbia
Hamilton, Ontario	Victoria, Britsh Columbia
St. Catherines, Ontario	

§74.598 Inspection of cars at interchange. (a) Cars containing explosives in division 1.1 or 1.2 which are offered by connecting lines must be carefully inspected by the receiving line on the outside, including the roof. These cars must not be forwarded until all discovered violations have been corrected.

(b) If the car shows evidence of, or if there is any reason to suspect that it has received rough treatment, the lading must be inspected and placed in proper condition before the car is permitted to proceed.

§74.599 Handling on self propelled cars. (a) Explosives, division 1.1, 1.2, 1.3 and 1.5 must not be transported in any self-propelled car operated by electric or other motive power, if such car is carrying passengers.

(b) Dangerous commodities other than explosives division 1.1, 1.2, 1.3, and 1.5 when transported in self-propelled cars, must be carried in a compartment of such cars in which there shall be no electrically operated apparatus, or electric circuits, other than circuits in conduits properly installed.

§74.601 Calcium hypochlorite compounds, dry, involved in fires. (a) Calcium hypochlorite compounds, dry, packed in metal drums when involved in cars where fire has occurred from any cause must be held at least five days before forwarding. Drums showing evidence of spontaneous heating or stress from internal pressure must not be reshipped.

APPENDIX A — PROCEDURE—TANK CAR EMISSION STANDARD BASED ON LOWER EXPLOSIVE LIMIT

This standard utilizes a portable combustible gas tester for the measurement of hydrocarbon concentration in air and expresses the values as a percentage of the lower explosive limit (% of LEL). These readings are to be taken within the enclosed dome area of the Liquefied Petroleum Gas (LPG) tank car.

Method

A gaseous sample is withdrawn from the manway of the LPG tank car at standardized conditions and analysed by a portable combustible gas detector. The results obtained as a percentage of the lower explosive limit relate to the concentration of hydrocarbons in the manway.

Apparatus

A portable combustible gas detector, approved as to type by the Director of Operation, suitable for taking % of LEL readings with a precision of at least 1% of LEL in the 0 to 10% range and at least 2% of LEL in the 10 to 100% range. (Dual Range Gas Tester).

Approximately 50 cm long 0.4 cm inside diameter copper sample probe which is connected to the detector by no more than 100 cm long teflon or special synthetic rubber tubing. A stainless steel sample probe may also be used. It should be covered by insulating material to eliminate the possibility of spark.

Calibration

If the detector is in daily use, calibration using a standard propane/nitrogen mixture shall be performed at least once a week. If the detector has not been in regular service the calibration shall be checked prior to use.

The procedure for calibration shall be as indicated in the manufacturer's instrument manual for the detector.

Procedure

After the dome housing cover has been closed for at least 10 minutes, insert the sample probe through a port hole about 30 cm radially in the manway. The sample probe should be in horizontal position and should be resting on the lower edge of the port hole.

Obtain a % of LEL reading by following the instructions outlined in the operating manual of the detector.

If the reading is above 10%, open the dome housing cover for a sufficient time to allow the gases inside to be vented off. Then close it for at least ten minutes and take a second reading using the previous procedure.

If the two readings differ by more than 2% of LEL, make a third measurement from another port hole.

If the final reading is above 10% of the LEL, the tank car shall be considered leaking and shall not be transported until proper repairs are effected.

If any emissions are encountered and determined to be originating from the tank car's manway gasket, the 10% of LEL criteria will not apply. Corrective action shall be taken immediately.

PART 75—REGULATIONS APPLYING IN EXPRESS AND BAGGAGE SERVICE

Sec.

75.650 Scope.
75.651 Permitted express shipments.
75.655 Protection of packages.
75.701 Prohibited Baggage.
75.703 Accepted Commodities
75.706 Exemptions.

§75.650 Scope. (a) This Part prescribes requirements (in addition to those contained in Parts 71, 72, 73, 74, and 78) applicable to the carriage of dangerous goods by rail express carriers where any portion of such carriage is on a passenger carrying train, and to the carriage of dangerous goods in baggages service on any passenger carrying train.

§75.651 Permitted express shipments. (a) Dangerous goods may not be accepted for transportation or transported by rail express except in the quantities specified in Column 8(b) of the table to section 72.5 as it read immediately before July 1, 1985. (Copies of this table may be obtained from the Director of Operation upon request).

§75.655 Protection of packages.(a) In handling packages containing explosives or other dangerous commodities, care must be taken to prevent them from falling or from being broken. They must not be thrown, dropped, or rolled. Packages bearing the marking "THIS SIDE UP" or "THIS END UP" must be so handled and loaded.

(b) Packages must be so loaded that they cannot fall to the car floor and in such manner that other freight cannot fall onto or slide against them.

(c)Unless cars are equipped with a suitable guard or screen to prevent the lading coming in contact with hot steam pipes, or heat exits used in electrically-heated equipment packages containing explosives or other dangerous articles must not be transported in them.

(d) Dangerous commodities other than non-flammable gases should be loaded in a place that will permit their ready removal in case of fire or wreck, and near the car door, if possible. They must not be loaded in cars or stored in stations near steam pipes or other sources of heat. Explosives, flammable liquids, and flammable compressed gases must not be loaded, transported, or stored in cars or stations equipped with lighted heaters or where open-flame lights or stoves or electric devices having exposed heating coils are used.

(g) Not more than 10 gas indentification sets may be transported in any car at any time.

(k) Material marked as or known to be poison (Division 6.1) shall not be transported in the same car with material which is marked as or known to be foodstuffs, feeds, or any other edible material intended for consumption by humans or animals.

(l) A car which has been used to transport material marked as or known to be poison (Division 6.1) must be inspected for contamination and must not be returned to service until such contamination has been removed.

§75.701 Prohibited Baggage. (a) Shipments of Class 1 goods, except small arms ammunition included in Division 1.4S, or any other dangerous goods, except as provided in this Part, must not be accepted or transported in rail baggage service.

§75.503 Acceptable commodities. (a) Gases included in Divisions 1 and 2 of Class 2 and flammable liquids in Class 3 in CTC-approved containers may be accepted for transportation in rail baggage service. Containers must not be loaded in passenger-carrying rail cars, or in cars with operating open-flame heaters or heaters with exposed electric coils. Containers of dangerous commodities must not be transported in close proximity to steam pipes.

§75.706 Exemptions. (a) The Director of Operation may designate certain portions of rail lines as remote lines on which the movement of essential dangerous goods in rail baggage service is permitted.

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Specification 1A
BOXED CARBOYS

(Glass, Earthenware, Clay, or Stoneware)

1. Compliance. (a) Required in all details.

2. Reuse of packages. (a) Parts of outside container and cushioning must be replaced when broken, decayed, or inefficient in any way.

(b) Carboys with lip cracked or badly chipped not authorized; gasket seat must be even. Packages must be capable of passing tests prescribed in Sec. 9.

3. Closing devices required. (a) As follows except when otherwise authorized in the packing regulations:

(1) Acid proof stoppers or other devices, with gaskets, securely fastened; venting closures are required when necessary to prevent internal pressure in excess of 8 pounds per square inch gauge at 130°F.

(2) Glass stoppers ground to fit and securely fastened are authorized when internal pressures do not exceed 8 pounds per square inch gauge at 130°F.

4. Capacity and marking of carboy. (a) Containers 4 to 11 gallons are classed as carboys. Must be embossed to indicate maker and year of manufacture; mark of maker to be registered with the Bureau of Explosives through the Commission.

5. Glass carboys. (a) Thoroughly annealed; top of lip smooth and even; must contain at least 20 pounds of glass for 10-gallon carboys and 21 pounds for 11-gallon carboys. Glass in side walls should be well distributed and at least 1/16" thick. Defective carboys not authorized.

6. Earthenware, clay, or stoneware carboys. (a) Of acidproof material.

7. Outside containers. (a) Wooden boxes completely enclosing body of carboy or wooden boxes completely enclosing body and neck of carboy, with 4 vertical corner posts, two cleats for shoes and two carrying cleats. (See paragraph (e) of this section).

(b) Lumber to be well seasoned, commercially dry, and free from decay, loose knots, knots that would interfere with nailing, and other defects that would materially lessen the strength.

(c) Assemble sides and ends with grain of wood horizontal and nail as specified. Nail bottom to sides and ends; fasten top by any efficient means. Cleats for shoes to be along edges of bottom parallel to carrying cleats. (See paragraph (e) of this section).

(d) Parts and dimensions as follows:

	Minimum dimensions			Nails—Sides and bottom	
Nominal Carboy capacity not over	Thickness—Sides, top, bottom and ends	[1] Vertical corner posts	[1] Carrying cleats and shoes	[2] Size, not less than	[2] Spacing, average not over
Gallons	Inch	Inches	Inches	Inch	Inches
4 to 6	5/8	5/8 × 2 1/2	5/8 × 1 7/8	2 1/4 2	2 1/4 2
6 to 11	25/32	25/32 × 3 1/8	25/32 × 2 11/32	2 3/4 2 1/2	2 3/4 2 1/2

[1] Other dimensions with equal cross section acceptable.

[2] Screws of equal efficiency authorized.

[3] Spacing 6 inches acceptable along edge grain of bottoms.

(e) In place of bottom cleats, the following is authorized: 2 angle irons at least 1¼" × 1¼" × 1/16", applied across grain of bottom boards from corner to corner, supported by acid-resistant metal corner supports securely fastened to sides and ends at each bottom corner so as to raise bottom boards of box at least ¾" above bottom of corner supports; nailing along end grain of bottom boards not required.

(f) Special box. Must comply with this specification except as follows: Bottom of box must be nailed to 4 nailing cleats which form part of the sides and ends of box. Top of box must be reinforced by 2 cleats of ½-inch lumber 4 inches wide, extending the entire width of the top at right angles to the sides of the boards forming the top; a vacant space of 1 inch between outside edge of top and cleat should be allowed for nailing top to box; parts and dimensions must be as shown:

	Minimum dimensions					Nails, sides, and bottom	
Carboy capacity, not over (gallons)	Thickness of sides, top and ends	Thickness of bottom	Thickness and width of bottom nailing cleats	Carrying cleats and shoes	Triangular vertical corner posts	Size not less than [1]	Spacing average not over [2]
	Inch	Inches	Inches	Inches	Inches	Inch	Inches
4 to 11	1/2	25/32	25/32 × 2 1/2	25/32 × 2 1/2	2 1/2 × 2 1/2 (abort sides)	2 1/2 3	2 1/8 2 3/4

[1] Screws of equal efficiency authorized.

[2] Spacing 6 inches acceptable along edge grain of bottoms.

(g) Cushioning materials. Cushioning devices or materials must be of such type, or be so secured within the outer container that the carboy cannot shift in a way that cushioning efficiency is reduced.

8. Marking of outside container. (a) On each container with letters and figures at least ¾ inch high applied by hot branding iron or printing ink of a colour sharply contrasting to background of package with high pressure dies as follows:

(1) CTC-1A. This mark shall be understood to certify that the complete package complies with all specification requirements.

(2) Name or symbol (letters) of company setting up the package, or other party assuming responsibility for its compliance with specification requirements; this must be registered with the Bureau of Explosives through the Commission and located just above or below the mark specified in paragraph (a) (1) of this section.

9. Tests. (a) Apparatus. Standard required. Detail prints can be obtained from Bureau of Explosives, through the Commission.

(b) Method. Fill with water to lower edge of neck; swing 55″ measured from wall to nearest bottom edge of basket:

(1) Side shock; test at least 10 carboys.

(2) Bottom shock; test at least 5 carboys.

NOTE 1: In instances where 99 or less carboys are in service during either 6-month period of the year it shall be acceptable to test 10 percent of the total but not less than 3 carboys on both the side and bottom swing. If this provision is used, the report of tests result must so state.

(c) Acceptable results. 90 per cent of carboys must not break under side shock and same for bottom shock, except both results must be 100 per cent if modified test authorized by Note 1 of paragraph 9(b) is used.

(d) When required. By each manufacturer, and each shipper who fills and ships new or used carboys; during each 6 months of each year, one series each year to be witnessed by representative of the Commission or Bureau of Explosives; separate test required for:

(1) New packages (those with new outside container).

(2) Used packages.

(3) Packages with carboys differing over 2 gallons.

(4) Packages differing in kind of cushioning.

(e) Exception. Tests not required by shipper who fills and ships or reships for one shipment only packages obtained from a manufacturer or shipper who has had tests made.

(f) Reports. Required to be made to the Commission and Bureau of Explosives on form as shown:

10. Approval of veneer, plywood and laminated wood boxes. (a) Boxes of veneer, plywood, laminated wood, or any combination thereof, which comply with Sect. 1 to Sec. 10 (except Sec. 7(a), (c) and (d), are approved provided:

(1) Outside containers shall completely enclose body of carboy or body and neck of carboy.

(2) That complete inner packing and box specifications have been filed with and approved by the Bureau of Explosives through the Commission.

(3) That these boxed carboys pass the regular test prescribed in Sec. 9.

(4) That boxed carboys after a minimum service period of 6 months pass the tests prescribed in sec. 9.

(5) That a detailed report of tests prescribed under paragraph (a)(4) of this section has been filed with and accepted as satisfactory by the Commission and Bureau of Explosives.

REPORT OF TEST OF CARBOYS
(As required by CTC Regulations and Specifications)

(Place) .....
(Date) .....
Test made for .....
(Give name and address of plant for which tests were made) .....
.....

Description	Results					
		55-inch swing			55-inch swing	
	No. of test	Side	Bottom	No. of test	Side	Bottom
Capacity	1			13		
Condition [1]	2			14		
	3			15		
Type of inside container [2]	4			16		
	5			17		
Cushioning [3]	6			18		
	7			19		
Diameter of bottle	8			20		
	9			21		
Size of outside container	10			22		
(inside)	11			23		
	12			24		

Specification mark is .....
Identification symbol is .....
Remarks .....
.....
.....
(Signature) .....
(Per) .....

[1] State whether outside container is new or used.
[2] State whether glass, earthenware, etc.
[3] State whether hay, mineral wool, ground cork, excelsior, wood strips .....type, cork pads.....type, etc.

Specification 1D
BOXED GLASS CARBOYS

1. Compliance. (a) Required in all details.

2. Reuse of packages. (a) Parts of outside container and cushioning must be replaced when broken, decayed, or inefficient in any way.

(b) Carboys with lip cracked or badly chipped not authorized; gasket seat must be even. Packages must be capable of passing tests prescribed in sec. 8.

3. Closure. (a) Threaded screw cap which shall be constructed of a suitable plastic or other material resistant to lading.

(b) Gasket or lining for cap must be used and shall be resistant to lading and;

(1) Must be liquid tight or;

(2) Must be liquid tight up to venting pressure when such venting is prescribed for the material which is to be shipped.

(c) At least one complete continuous thread must be engaged with gasket in place.

4. Capacity and marking of carboy. (a) Capacity. 5.5 gallons nominal capacity, 6.0 gallons overflow, tolerance plus or minus 10 fluid ounces.

(b) Marking. Each carboy bottle must be embossed on bottom as follows:

Maker's mark (to be registered with Bureau of Explosives through the Commission).

Year of Manufacture
CTC-1D

5. Glass carboy bottle. (a) Must be machine-blown, thoroughly and properly annealed, with screw thread finish having at least one continuous thread to accommodate closure; top of lip smooth and even; must contain 14 pounds of glass, tolerance minus 8 ounces plus 16 ounces. Minimum thickness to be .075 inch. Defective carboys not authorized.

6. Outside containers. (a) Wooden boxes completely enclosing body and neck of carboy, with 4 vertical corner posts, two cleats for shoes and two carrying cleats. An opening not exceeding 3 inches in width may be provided directly above the neck of bottle, if the top of the box in made of up not more than two pieces of lumber of 25/72 inch thickness. Bottom board of the two ends of the box must be constructed of lumber at least one inch thick, must be flush with the carrying cleats and be at least 2¾ inches in width. Cleats or other fasteners used to secure cover must not extend beyond carrying cleats.

(b) Lumber to be well seasoned, commercially dry, and free from decay, loose knots, knots that would interfere with nailing, and other defects that would materially lessen the strength.

(c) Assemble sides and ends with grain of wood horizontal and nail as specified. Nail bottom of sides and ends; fasten top by any efficient means (friction closure not authorized). Cleats for shoes to be along edges of bottom parallel to carrying cleats and at right angle to the direction of bottom board or boards.

(d) Parts and dimensions as shown:

Carboy capacity, nominal not over (gallons)	Minimum dimensions			[4] Nails—Sides and bottom	
	[1] Thickness—Sides, top, bottom, and ends	[2] Vertical corner posts	[3] Carrying cleats and shoes	Size	[5] Spacing average
	Inch	Square inches	Inches	Inch	Inches
5.5	½	2.0	½ × 2¾	2	2

[1] Except as prescribed or permitted under sec. 6 (a).
[2] Cross sectional area.
[3] Other dimensions with equal cross section acceptable. In lieu of separate carrying clears, side board, at point where cleat should be located, may be constructed of lumber not less than one inch thick so that overhang will be at least ½ inch.
[4] Screws of equal efficiency authorized.
[5] Spacing 6 inches acceptable along edge grain of bottoms.

(e) Cushioning materials. Cushioning devices or materials must be of such type, or be so secured within the outer container, that the carboy cannot shift in a way that cushioning efficiency is reduced.

7. Marking of outside container. (a) On each container with letters and figures at least ¾ inch high applied by hot branding iron or printing ink of a colour sharply contrasting to background of package with high pressure dies as follows:

(1) CTC-1D. This mark shall be understood to certify that the complete package complies with all specification requirements.

(2) Name or symbol (letters) of company setting up the package, or other party assuming responsibility for its compliance with specification requirements; this must be registered with the Bureau of Explosives through the Commission and located just above or below the mark specified in paragraph (a)(1) of this section.

8. Tests. (a) Apparatus. Standard required. Detail prints can be obtained from Bureau of Explosives, through the Commission.

(b) Method. Fill with water to lower edge of neck; swing 55″ measured from wall to nearest bottom edge of basket:

(1) Side shock; test at least 10 carboys.

(2) Bottom shock; test at least 5 carboys.

NOTE 1: In instances where 99 or less carboys are in service during either 6-month period of the year it shall be acceptable to test 10 per cent of the total but not less than 3 carboys on both side and bottom swing. If this provision is used, the report of test results must so state.

(c) Acceptable results. 90 per cent of carboys must not break under side shock and same for bottom shock, except both results must be 100 per cent if modified test authorized by Note 1 of paragraph 8 (b) is used.

(d) When required. By each manufacturer and each shipper who fills and ships new or used carboys; during each 6 months of each year, one series each year to be witnessed by representative of the Commission or Bureau of Explosives separate tests required for:

(1) New packages (those with new outside container).

(2) Used packages.

(3) Packages differing in kind of cushioning.

(e) Exception. Tests not required by shipper who fills and ships or reships for one shipment only packages obtained from a manufacturer or shipper who has had tests made.

(f) Reports. Required to be made to the Commission and Bureau of Explosives on form as shown:

REPORT OF TESTS OF CARBOYS
(As required by CTC Regulations and Specifications)
(Place) .....
(Date) .....
Test made for .....
(Give name and address of plant for which tests were made)

Description	Results					
		55-inch swing			55-inch swing	
	No. of test	Side	Bottom	No. of test	Side	Bottom
Capacity	1			13		
Condition[1]	2			14		
	3			15		
Type of inside container[2]	4			16		
	5			17		
Cushioning[1]	6			18		
	7			19		
Diameter of bottle	8			20		
	9			21		
Size of outside container (inside)	10			22		
	11			23		
	12			24		

Specification mark is .
Identification symbol is .....
Remarks

(Signature)
(Per)

[1] State whether outside container is new or used.

[2] State whether glass, earthenware, etc.

[3] State whether hay, mineral wool, ground cork, excelsior, wood strips.....type, cork pads.....type, etc.

(g) Internal pressure test. Bottles shall be capable of withstanding a sustained internal pressure of 20 psi. gauge for a 15-day period. Bottle manufacturer shall demonstrate to the Commission that bottles of a proposed design will meet this test prior to start of production.

(h) Hydrostatic pressure test. One bottle selected at random from each 200 produced on each mould shall be subjected to an instantaneous hydrostatic pressure test to bursting. Pressure at which bottle bursts must not be less than 40 psi. gauge. If bottle so tested fails at a pressure less than 40 psi., 12 additional samples must be selected from the same lot of 200 bottles and tested in the same manner. All 12 samples must pass required test, otherwise entire lot shall be rejected.

Specification 1EX
GLASS CARBOYS IN PLYWOOD DRUMS
SINGLE TRIP CONTAINER

1. Compliance. (a) Required in all details.

2. Lumber. (a) To be well seasoned, commercially dry, and free from decay, loose knots, knots that would interfere with nailing, and other defects that would materially lessen the strength.

3. Closing devices required. (a) As follows except when otherwise authorized in the packing regulations:

(1) Acidproof stoppers or other devices, with gaskets, securely fastened; venting closures are required when necessary to prevent internal pressure in excess of 8 pounds per square inch gauge at 130°F.

(2) Glass stoppers ground to fit and securely fastened are authorized when internal pressures do not exceed 8 pounds per square inch gauge at 130°F.

4. Capacity and marking of carboy. (a) Containers must be 4 to 5½ gallons capacity and embossed to indicate maker and year of manufacture.

5. Glass carboys. (a) Thoroughly annealed; top of lip smooth and even. Glass in side walls should be well distributed and at least 1/18 inch thick. Defective carboys not authorized.

6. Outside containers. (a) Plywood drums completely enclosing body and neck of carboy and constructed as follows:

(1) Body shell. To be of two plies of hardwood veneer, each not less than 1/12 inch in thickness, firmly glued together, with the grain of the outside ply parallel and the inner ply vertical to the heads. The body shall be butt-jointed and shall be fastened on the outside with a 28-gauge steel strip, not less than 1½ inches in width. 17-gauge staples shall be driven on each side of the joint, spaced not more than 1½ inches apart and clinched on the inside of the body.

(2) Heads. Top and bottom heads shall be of three-ply hardwood veneer, each ply not less than 1/12 inch in thickness, all firmly glued together, with the grain of each outer ply at right angles to the grain of the centre ply. Each head shall be circled to fit snugly inside of the body. Interior heads shall be of the same construction.

(3) Hoops. To be of hardwood veneer, not less than 1¾ inches wide by ⅛ inch thick. Hoops shall be fastened to the body by 17-gauge staples on not less than 3-inch centres and shall be overlapped not less than 3 inches.

(4) Head liners. When plywood cushioning is used the inner lining strips which support the plywood cushion shall be of hardwood veneer not less than 1/5 inch in thickness and ⅝ inch in width and shall butt or slightly gap. All other head lining strips shall be made of hardwood veneer not less than 1/5 inch in thickness and ⅝ inch in width and shall overlap not less than 3 inches. The bottom head liner and the inside liner strips for the false head and support of the top head shall be fastened by 17-gauge staples on not less than 3-inch centres. The staples shall be driven through the outer hoop and body and clinched on the inside of the veneer strips; except that the strips holding the false head shall have staples only through the body shell and liner. The top liner which forms the final closure shall be fastened to the body by 14-gauge staples driven through the head liner and body into the outer hoop on not less than 4-inch centres.

(5) Battens. A ⅝ inch by 2 inch batten shall be applied to top and bottom and shall be secured at each end by two nails driven through the hoops and shell.

(b) Cushioning materials. Cushioning devices or materials must be of such type, or be so secured within the outer container, that the carboy cannot shift in a way that cushioning efficiency in reduced.

7. Approval. (a) The complete inner packing and drum specification must be filed and approved by the Commission.

8. Marking of outside container for compliance with specification. (a) On each container with letters and figures at least ¾ inch high applied by hot branding iron or printing ink of a colour sharply contrasting to background of package with high pressure dies as follows:

(1) CTC-1EX. This mark shall be understood to certify that the complete package complies with all specification requirements.

(2) Name or symbol (letters) of company setting up the package, or other party assuming responsibility for its com-

pliance with specification requirements; this must be registered with the Bureau of Explosives through the Commission and located just above or below the mark specified in paragraph (a)(1) of this section.

9. Marking of outside container for use. (a) Each outside container must also be plainly marked "SINGLE TRIP CONTAINER" just above or below the mark specified in paragraph 8(a)(1).

10. Tests. (a) Apparatus. Standard required. Detail prints can be obtained from Bureau of Explosives, through the Commission.

(b) Method. Fill with water to lower edge of neck; swing 55″ measured from wall to nearest bottom edge of basket:

(1) Side shock; test at least 10 carboys.

(2) Bottom shock; test at least 5 carboys.

NOTE 1: In instances where 99 or less carboys are in service during either 6-month period of the year it shall be acceptable to test 10 per cent of the total but not less than 3 carboys on both the side and bottom swing. If this provision is used, the report of test results must so state.

(c) Acceptable results. 90 per cent of carboys must not break under side shock and same for bottom shock, except both results must be 100 per cent if modified test authorized by Note 1 of paragraph 10(b) is used.

(d) When required. By each manufacturer, and each shipper who fills and ships new carboys; during each 6 months of each year, one series each year to be witnessed by representative of the Commission or Bureau of Explosives; separate tests required for:

(1) New packages (those with new outside containers).

REPORT OF TESTS OF CARBOYS
(As required by CTC Regulations and Specifications)

(Place) .....
(Date)

Test made for .....
(Give name and address of plant for which tests were made)

Description of package	Results					
		55-inch swing			55-inch swing	
	No. of test	Side	Bottom	No. of test	Side	Bottom
Capacity	1			13		
Condition [1]	2			14		
	3			15		
Type of inside container [2]	4			16		
	5			17		
Cushioning [3]	6			18		
	7			19		
Diameter of bottle	8			20		
	9			21		
Size of outside container	10			22		
(inside)	11			23		
	12			24		

Specification mark is .....
Identification symbol is .....
Remarks .....

(Signature)
(Per) .....

[1] State whether outside container is new or used.

[2] State whether glass, earthenware, etc.

[3] State whether hay, mineral wool, ground cork, excelsior, wood strips.....type, cork pads.....type, etc.

(3) Packages differing in kind of cushioning.

(e) Exception. Tests not required by shipper who fills and ships or reships for one shipment only packages obtained from a manufacturer or shipper who has had tests made.

(f) Reports. Required to be made to the Commission and Bureau of Explosives on form as shown:

Specification 1H
POLYETHYLENE CARBOYS

In Low Carbon Steel or Other Equally Efficient Metal Crates.

1. Compliance. (a) Required in all details.

2. Capacity and marking of carboy. (a) Containers 5 to 11 gallons capacity are classed as carboys. Actual capacity must be marked capacity plus 5 per cent minimum. Must be permanently marked to indicate marked capacity, maker (symbols, if used, must be registered with the Bureau of Explosives through the Commission) month and year of manufacture and CTC-1H in figures and letters at least ¼ inch high.

3. Polyethylene carboys. (a) Carboys shall be made of polyethylene with no plasticisers or additives and have a maximum melt index value of 2.5 grams per 10 minutes as determined in accordance with method acceptable to the Commission or Bureau of Explosives. Carboys must have a minimum weight and roll thickness in accordance with the following table:

Marked capacity	Minimum wall thickness	Minimum weight of bottles
Gallons	Inch	Pounds
5	1/16	3
5½	1/16	4
11	1/16	8

(b) Closing device shall be of material resistant to the lading and adequate to prevent leakage. Opening for closure shall not be over 3½ inches in diameter.

(c) Polyethylene carboys, as manufactured and filled to marked capacity with a material which remains in a liquid form, shall be capable of withstanding a 4-foot drop without leakage, after prior conditioning so that contents will be 0° F. or colder, onto solid concrete on any portion of the carboy.

4. Outside Containers. (a) Metal crates:

(1) Specifications for each size outside container must be filed by each plant prior to start of production and be approved by the Bureau of Explosives through the Commission.

5. Marking of outside container. (a) Each outside container must be plainly marked by attachment of a metal plate, or permanent marking in contrasting color directly on the polyethylene carboy in a visible area. Marking must be in letters and figures at least ¾ inch high and must be by embossing or stamping when applied on metal plates. Marking must be as follows:

(1) CTC-1H. This mark shall be understood to certify that the complete package complies with all specification requirements.

(2) Name or symbol (letters) of company setting up the package, or other party assuming responsibility for its compliance with the specification requirements; this must be registered with the Bureau of Explosives through the Commission and located just above or below the mark specified in paragraph (a)(1) of this section.

6. Tests. (a) One sample, taken at random and with inner container filled to marked capacity with water and closed as for use, shall be capable of withstanding prescribed tests without leakage or serious rupture of outer container. Tests shall be made of each size by each company starting production. The type tests are as follows:

(1) Complete package must be capable of withstanding 2 drops from a height of 4 feet onto solid concrete, the first drop to be made diagonally so top corner will strike the concrete; the second drop onto a 2-inch by 6-inch timber resting on the concrete with the 6-inch leg vertical, the drop being made with the package in a horizontal position and at right angles to the timber so that impact is near the center of the crate side-wall members.

Specification 1K

GLASS CARBOYS

Cushioned with expandable polystyrene in wooden wirebound box outside containers.

1. Reuse of packages. (a) Top, base or side sections of outside container and cushioning must be replaced when broken, decayed, or inefficient in any way.

(b) Carboys with lip cracked or badly chipped not authorized; gasket seat must be even. Packages must be capable of passing tests prescribed in paragraph 8.

2. Closing devices required.(a) As follows except when otherwise authorized in the packing regulations:

(1) Acidproof stoppers or other devices, with gaskets, securely fastened; venting closures are required when necessary to prevent internal pressure in excess of 8 pounds per square inch gauge at 130°F.

(2) Glass stoppers ground to fit and securely fastened are authorized when internal pressures do not exceed 8 pounds per square inch gauge at 130°F.

3. Capacity and marking of carboy.(a) Containers 4 to 11 gallons are classed carboys; must be embossed to indicate maker and year of manufacture; mark of maker to be registered with the Bureau of Explosives.

4. Bottles. (a) 11-gallon carboys. Must be thoroughly annealed; top of lip smooth and even; must contain at least 21 pounds of glass. Glass in sidewalls should be well distributed and at least 1/16 inch thick.

(b) 5 1/2 gallon carboys. Must be machine-blown, thoroughly and properly annealed, with screw thread finish having at least one continuous thread to accommodate closure; top of lip smooth and even; must contain 14 pounds of glass, tolerance minus 8 ounces plus 16 ounces. Minimum thickness to be 0.075 inch. Defective carboys not authorized.

5. Cushions.(a) Expandable polystyrene, molded to produce a completely fused closed cell structure and designed as to provide a snug fit in all areas of contact with the inside container, in the following forms:

(1) Formed in place around the inside container; density 1.25 plus or minus 0.25 lbs. per cubic foot, minimum thickness of sidewalls 1 inch and of bottom 1.5 inches.

(2) Preformed cushions, one top and one bottom; density 2.75 plus or minus 0.25 lbs. per cubic foot, minimum thickness of sidewalls 1 inch and bottoms 1.37 inches.

(b) Assembled containers must be capable of passing tests prescribed in paragraph 8.

6. Outside containers.(a) Wooden wirebound boxes completely enclosing body of carboy or completely enclosing body and neck of carboy.

(b) Lumber shall be as follows:

(1) Lumber shall be well seasoned and commercially dry; free from decay, objectionable knots, slanting shakes, sharp cross grain, and other defects that materially lessen the strength. Grain of wood in cleats and battens must not cross piece within its length.

(2) Authorized tolerances; cleats, battens and handles, minus 1/32 inch, single thickness veneer, minus 5 per cent; resawn boards, 1/32 inch below specified thickness for boards 1/4 inch or more thick.

(3) Woods authorized are in the following groups:

Group 2		
Southern yellow pine	North Carolina pine	Larch (Tamarack)
Hemlock	Douglas fir	
Group 3		
White elm	Pumpkin ash	Tupelo
Red gum	Black ash	Maple-soft or silver
Sycamore	Black gum	
Group 4		
Hard maple	Hackberry	White ash
Beech	Birch	Hickory
Oak	Rock elm	

(4) Where plywood is authorized, it must be exterior grade moisture-resistant type.

(c) Binding wires and staples shall be as follows:

(1) Galvanized coated annealed steel or other material of equal strength, Washburn and Moen sizes.

(d) Minimum construction requirements for 11-gallon carboys shall be as shown:

(1) Minimum construction requirements for 5 1/2 gallon carboy shall be as follows:

Outside container closure. When prepared for shipment, top hood cover must be positively secured to body of container.

(e) Assembly:

Wirebound boxes	Square box for preformed cushions	Octagonal box for preformed cushions	Cylindrical box for preformed cushions	Octagonal box for formed-in-place cushions
Faceboard thickness (sides only—without handles cleats)				
Group 2 woods	5/16"	5/16"	5/16"	1/4"
Group 3 and 4 woods	1/4"	1/4"	1/4"	1/4"
Faceboard thickness (sides only—with handles cleats)				
Group 2 woods	3/8"	3/8"	5/16"	1/4"
Group 3 woods	5/16	5/16	5/16	1/4
Cleats	13/16" × 7/8	13/16" × 7/8	13/16" × 7/8	13/16" × 7/8
Handle Cleat	2 1/8" × 7/8	2 1/8" × 7/8	None	2 1/8" × 7/8
Binding wires				
Number and gauge over outside cleats	2-12 gauge	2-12 gauge	2-12 gauge	2-12 gauge
Number and gauge intermediate wires	3-13 gauge	3-13 gauge	2-12 gauge	2-13 gauge
Staples	1 1/4"-16 gauge	1 1/4"-16 gauge	1"-16 gauge	1 1/4"-16 gauge
Top[1]				
Face material thickness	9/16"	9/16"	1/2" plywood	9/16"[2]
Battens	4-1 1/8" × 7/8"	2-1 3/8" × 7/8"	None	2-1 3/8" × 7/8"
Base				
Face material thickness	9/16"	9/16"	5/8" plywood	9/16"[2]
Battens	4-1 1/8" × 7/8"	3-1 3/8" × 7/8"	2-1 1/8" × 7/8"	3-1 3/8" × 7/8"
Runners	3 5/8" × 9/16"	2-1 7/8" × 7/8"	2-1 5/8" × 7/8"	2-1 7/8" × 7/8"

[1] A hole of suitable type may be made in top of box to provide for the protruding neck of inner container. There shall be 1 inch minimum clearance between bottle and inside of hole.

[2] One-half inch plywood face material authorized.

Wirebound boxes	Dimensions
Faceboard thickness	1/4"
Cleats	1 3/16" × 7/8"
Handle cleats	2 1/8" × 7/8"
Binding wires	
Number and gauge over outside cleats	2-12 gauge
Number and gauge intermediate wires	2-13 gauge
Staples	1 1/4"—16 gauge
Base	
Face material thickness	3/8" plywood
Battens	1 3/8 × 7/8"
Top (hood cover)	
Side face board thickness	1/4"
Cleats	1 3/16" × 7/8"
Binding wires	
Number and gauge over outside cleats	2-13 gauge
Top faceboard thickness	3/8" plywood

(1) The box shall be constructed to provide a snug fit with the cushioning for the inside container. Wooden shims of correct thickness may be used to keep carboy tight in overpack.

(2) The boxes shall be closed with threaded loop fasteners using a regular clinch.

7. Marking of outside container.(a) On each container with letters and figures at least 3/4 inch high applied by hot branding iron or coloured ink with high pressure dies as follows:

(1) CTC-1K. This mark shall be understood to certify that the complete package complies with all specification requirements.

(2) Name or symbol (letters) of company setting up the package, or other party assuming responsibility for its compliance with specification requirements. This must be registered with the Bureau of Explosives through the Board and located just above or below the mark specified in paragraph (a)(1) of this section.

8. Tests. (a) Apparatus. Standard required. Detail prints can be obtained from the Bureau of Explosives.

(b) Method. Fill with water to lower edge of neck; swing 55 inches measures from wall to nearest bottom edge of basket:

(1) Test 10 carboys each against bottom and one side.

NOTE 1: Instances where 99 or less carboys are in service during either 6-month period of the year it shall be acceptable to test 10 per cent of the total but not less than 3 carboys on both the side and bottom swing. If this provision is used, the report of test results must so state.

(c) Acceptable results. One hundred per cent of carboys must not break under side or bottom shocks. If failures occur, the test is to be repeated with an additional 10 carboys for which the passing requirements shall be 100 per cent.

(d) When required. By each manufacturer, and each shipper who fills and ships new or used carboys; during each 6 months of each year, one series each year to be witnessed by representative of the Bureau of Explosives; separate tests required for:

(1) New packages.

(2) Used packages.

(3) Packages differing in kind or shape of cushioning.

(e) Exception. Test not required by shipper who fills and ships or reships for one shipment only packages obtained from a manufacturer or shipper who has had tests made.

(f) Reports. Required to be made to the Bureau of Explosives on form as follows:

REPORT OF TESTS OF CARBOYS
(As required by BTC Regulations and Specifications)
(Place)

(Date)

Test made for

(Given name and address of plant for which tests were made)

Description of package	Results					
		55-inch swing			55-inch swing	
	No. of test	Side	Bottom	No. of test	Side	Bottom
Capacity	1			13		
Condition[1]	2			14		
	3			15		
Type of inside container[2]	4			16		
	5			17		
Cushioning[3]	6			18		
	7			19		
Diameter of bottle	8			20		
	9			21		
Size of outside container	10			22		
(inside)	11			22		
	12			24		

Specification mark is

Identification symbol is

Remarks

(Signature

(Per)

[1] State whether outside container is new or used.

[2] State whether glass, earthenware, etc.

[3] State whether hay, mineral woll, ground cork, excelsior, woodstrips. type cork pads type, etc.

Specification 1X

BOXED CARBOYS

5 to 5½ gallon for export only. Glass, earthenware, clay or stoneware. Single-trip container.

1. Compliance. (a) Required in all details.

2. Closing devices required. (a) As follows except when otherwise authorized in the packing regulations:

(1) Acidproof stoppers or other devices, with gaskets, securely fastened; venting closures are required when necessary to prevent internal pressure in excess of 8 pounds per square inch gauge at 130°F.

(2) Glass stoppers ground to fit and securely fastened are authorized when internal pressures do not exceed 8 pounds per square inch gauge at 130°F.

(3) For box: Two flat metal nailless straps, at least ⅝ inch by 0.020 inch, encircling top, sides, and bottom and securely sealed are required.

3. Capacity and marking of carboy. (a) Containers must be 5 to 5½ gallon size and embossed to indicate maker and year of manufacture.

4. Glass carboys. (a) Thoroughly annealed; top of lip smooth and even. Glass in side walls should be well distributed and at least 1/16 inch thick. Defective carboys not authorized.

5. Earthenware, clay, or stoneware carboys. (a) Earthenware, clay, or stoneware carboys of acidproof material.

6. Outside containers. (a) Wooden boxes completely enclosing body and neck of carboy, with 4 vertical corner posts. Top may consist of cap fitting snugly inside body of box and resting on corner posts.

(b) Lumber to be well seasoned, commercially dry, and free from decay, loose knots, knots that would interfere with nailing, and other defects that would materially lessen the strength.

(c) Assemble sides and ends with grain of wood horizontal and nail as specified; nail bottom to ends; fasten top by any efficient means.

(d) Parts and dimensions. Sides, top, and bottom at least ½ inch thick; vertical corner posts at least 2.25 square inches cross section; nails at least 2 inch at 2-inch intervals or 1¾ inch at 1¾-inch intervals.

(e) Cushioning materials. Cushioning devices or materials must be of such type, or be so secured within the outer container, that the carboy cannot shift in a way that cushioning efficiency is reduced.

7. Marking of outside container. (a) On each container with letters and figures at least ¾ inch high applied by hot branding iron or printing ink of a colour sharply contrasting to background of package with high pressure dies as follows:

(1) CTC-1X. This mark shall be understood to certify that the complete package complies with all specification requirements.

(2) Name or symbol (letters) of company setting up the package, or other party assuming responsibility for its compliance with specification requirements; this must be registered with the Bureau of Explosives through the Commis-

sion and located just above or below the mark specified in paragraph (a)(1) of this section.

8. Marking. (a) Each outside container must also be plainly marked "FOR EXPORT ONLY, NOT RETURNABLE" and the top must be marked "THIS SIDE UP".

9. Tests. (a) Apparatus. Standard required. Detail prints can be obtained from Bureau of Explosives, through the Commission.

(b) Method. Fill with water to lower edge of neck; swing 55" measured from wall to nearest bottom edge of basket:

(1) Side shock; test at least 10 carboys.

(2) Bottom shock; test at least 5 carboys.

(c) Acceptable results. 90 per cent of carboys must not break under side shock; same for bottom shock.

(d) When required. By each manufacturer and each shipper who fills and ships new or used carboys; during each 6 months of each year, one series each year to be witnessed by representative of the Commission or Bureau of Explosives; separate tests required for:

(1) New packages (those with new outside container).

(2) Packages differing in kind of cushioning.

(e) Exception. Tests not required by shipper who fills and ships or reships for one shipment only packages obtained from a manufacturer or shipper who has had tests made.

(f) Reports required to be made to the Commission and Bureau of Explosives on form as shown:

REPORT OF TESTS OF CARBOYS
(As required by CTC Regulations and Specifications)

(Place) .....

(Date) ... .

Test made for .....
(Give name and address of plant for which tests were made)

Description of package	Results					
	No. of test	55-inch swing		No. of test	55-inch swing	
		Side	Bottom		Side	Bottom
Capacity	1	.....	.....	13	.....	.....
Condition[1]	2	.....	.....	14	.....	.....
	3	.....	.....	15	.....	.....
Type of inside container[2]	4	.....	.....	16	.....	.....
	5	.....	.....	17	.....	.....
Cushioning[3]	6	.....	.....	18	.....	.....
	7	.....	.....	19	.....	.....
Diameter of bottle	8	.....	.....	20	.....	.....
	9	.....	.....	21	.....	.....
Size of outside container . (inside).	10	.....	.....	22	.....	.....
	11	.....	.....	23	.....	.....
	12	.....	.....	24	.....	.....

Specification mark is .....
Identification symbol is .....
Remarks .....
.....
.....

(Signature) .....

(Per) .....

[1]State whether outside container is new or used.
[2]State whether glass, earthenware, etc.
[3]State whether hay, mineral wool, ground cork, excelsior, wood stripe ..... type, cork pads ..... type, etc.

Specification 2C

INSIDE CONTAINERS, CORRUGATED FIBREBOARD CARTONS

1. Construction. (a) To be of double-wall board, 275-pound strength, or 2 thicknesses of double-faced board, 175-pound strength, Mullen or Cady test; slides or linings to be 1-piece with joint cloth-taped.

2. Outside container. (a) Outside container must be lined throughout with, and cartons separated by, double-wall corrugated fibreboard of 275-pound strength, Mullen or Cady test.

Specification 2D

INSIDE CONTAINERS, DUPLEX PAPER BAGS

1. Construction. (a) Bags to be at least 2 thicknesses of shipping sack Kraft paper, or equivalent, and as shown:

Maximum weight of contents (pounds)	Minimum[1] weight (per 500 sheets 24" × 36")	
	One Sheet	Other Sheet
	Weight[1] (pounds)	Weight[1] (pounds)
2	30	30
6	50	40
12	60	50
25	70	60

[1]Weight 15 per cent less authorized for rope paper containing 35 per cent or more of manila rope fibre.

2. Test. (a) Bags, filled and closed as for shipment, must be able to withstand drop of 4 feet onto concrete without rupture or sifting, except that 2-foot drop is acceptable for bags to contain 25 pounds.

Specification 2E

INSIDE POLYETHYLENE BOTTLE

1. General requirements. (a) Each bottle must meet the applicable requirements of § 73.24.

2. Rated capacity. (a) Maximum capacity must be not more than 4 quarts.

3. Materials of construction. (a) Each bottle must be made of a blow-moulding grade of polyethylene, constructed so that it will maintain its shape when standing empty and open.

(b) Wall thickness must not be less than 0.008 inch (0.2 millimeters).

(c) Polyethylene must have properties as specified in Table I of Appendix B, Page 325A.

4. Closure. (a) Closing device must provide a tight seal. Vented closures are not authorized unless otherwise provided for in Part 73.

5. Tests. (a) Each bottle must be capable of withstanding the prescribed tests without breaking or leaking.

(b) The test prescribed in paragraph (d)(1) of this section must be made on at least three random sample bottles

for each 1,000 bottles produced by each blow-moulding machine. The test must be performed at the start of initial production from each blow-moulding machine and upon any change in type of polyethylene or process method.

(c) The test prescribed in paragraph (d)(2) of this section must be made at least once each month on a minimum of three random sample bottles produced and upon any change in type of polyethylene or process method.

(d) Prescribed test:

(1) The bottle, filled to 98 per cent of capacity with water, must be dropped from a height of 4 feet onto a solid unyielding surface so as to drop diagonally on the top edge or any other part which is weaker.

(2) The bottle, filled to 98 per cent of capacity with a liquid which is compatible with polyethylene and which is liquid at 0°F., must be dropped from a height of 4 feet onto a solid unyielding surface, on any part of the bottle. Immediately prior to the test, the bottle and its contents must have been at a temperature of 0°F. or lower for at least 24 hours.

6. Marking. (a) Marking shall be as prescribed in § 73.24, except as follows:

(1) Marking shall be embossment in at least 1/16 inch figures for bottles of one quart or less capacity and at least 1/8 inch figures for bottles of more than one quart capacity as follows: "CTC-2E", the minimum thickness of the polyethylene in thousandths of inches (mils), and the year of manufacture (e.g., CTC-2E 15-69).

Specification 2F

INSIDE METAL CONTAINERS AND LINERS

1. Construction. (a) Containers over 1-gallon capacity and all lining must be at least 30 gauge, United States standard (commercial 107-pound tin plate) and sealed leak-proof.

Specification 2G

INSIDE CONTAINERS, FIBRE CANS AND BOXES

1. Capacity and thickness of metal and fibre. (a) Capacity not over 6 pounds, net. Metal tops, bottoms, and connections of suitable thickness are authorized. Minimum fibre thickness as follows:

(1) Up to 1/4-pound size: 0.021".

(2) Up to 1-pound size: 0.026".

(3) Up to 3-pound size: 0.036".

(4) Up to 6-pound size: 0.050", provided that 0.036" fibre heads with 130-pound strength[1] are authorized; or 0.028" with 175-pound strength[1]; or 0.036" with 90-pound strength[1], provided each container is wrapped with shipping sack Kraft paper of 60-pound base weight pasted thereon.

[1] Mullen or Cady test

Specification 2J

INSIDE CONTAINERS, WATERPROOF PAPER BAGS FOR LININGS

1. Material. (a) Two sheets of paper cemented together and creped to afford 25 per cent stretch; paper to be shipping sack Kraft, 30 pounds per ream (500 sheets, 24" × 36") before creping; total weight 90 pounds per ream.

2. Test. (a) Material folded into cones and filled with water to depth of 2" at 70°F. must not show water on outside within 24 hours.

3. Construction (a) Form to fit the outside container without stretching; seams and closures to afford a siftproof bag.

Specification 2K

INSIDE CONTAINERS, PAPER BAGS FOR LININGS

1. Paper and construction. (a) Shipping sack Kraft paper, creped; at least 45 pounds per ream (500 sheets, 24" × 36") before creping.

(b) Construction. Form to fit the outside container without stretching; seams and closure to afford a siftproof bag.

Specification 2L

LINING FOR BOXES

1. Box lining. (a) Box lining must be of strong paraffined paper, or other suitable material, without joints or other openings at the bottom or at sides of box, and shall fully protect contents in contact with top of box.

(b) Tensile strength of material must be at least 35 pounds with the grain and 17 pounds across grain, tested by direct pull on strips measuring 3" by 1". Average results of three or more tests with the grain and three or more across grain shall be used.

(c) Material shall be impervious to water and nitroglycerin at 77°F. Test for imperviousness shall consist of folding material into cones, loosely to avoid breakage at creases. Cones tested for nitroglycerin shall be filled to 1" depth; those for water to 2". No leakage of liquid shall occur during 24 hours' exposure.

(d) Material must transmit no oily or greasy stain to unglazed paper. Test shall consist of placing one thickness of material, with two thicknesses of unglazed paper on each side, on an oven at 104°F. for 24 hours, under pressure of a lead disc 1 1/2" thick and of 10 pounds weight resting edgewise on the paper.

(e) Saturating paraffin, when used, shall have melting point of 125°F. or above. Test shall consist of extracting paraffin from 1 ounce or more of material with ether. After evaporation of all ether, paraffin shall be melted and poured upon the surface of water contained in a

hemisperical dish approximately 3¾″ in diameter. Dish shall be three-fourths full of water above melting point of paraffin. Thermometer shall be placed with bulb three-fourths immersed in centre of dish. Water and paraffin should be allowed to cool until paraffin upon the surface of water commences to solidity. Temperature shall then be read and recorded as melting point of paraffin.

2. Bag. (a) Bag complying with requirements of paragraphs (b), (c), and (d) of this section also authorized.

(b) Material must be: 2 sheets of shipping sack Kraft paper joined by asphaltum, or equivalent; outer sheet at least 60 pounds and inner sheet at least 30 pounds per ream (500 sheets, 24″ × 36″); inner sheet coated with wax, or equivalent, with melting point at least 125°F.; compliance with paragraph 1(b) and (c) required.

(c) Seams must be pasted with adhesive not affected by nitroglycerin.

(d) Completed bag must be formed to fit outside container without undue strain and must be impervious to seepage of nitroglycerin.

Specification 2M

WATERPROOFED PAPER LINING

1. Waterproofed paper. (a) Waterproofed paper for box lining must be strong, folded or constructed without joints or openings at sides, bottoms, or ends, and shall fully protect contents at top of box.

Specification 2N

INSIDE CONTAINER, METAL CANS

1. Size. (a) Not over 14 pounds water capacity (388 cubic inches).

2. Material. (a) Tin plate, good quality as follows:

Maximum diameter of can	Minimum thickness of metal (inch)	
	In body	In heads
4 5/16 inches	0.01134 (IC-107 pound tin plate).	0.01305 (1XL-128 pound tin plate).
6 11/16 inches	0.01134 (IC-107 pound tin plate).	0.01485 (1XL-148 pound tin plate).

NOTE 1: Until further order of the Commission, the minimum thickness of metal in heads may be 1XL-107-pound tin plate for cans of not over 4 5/16 inch diameter and 1XL-135-pound tin plate for cans of not over 6 11/16 inches diameter, provided side seams are soldered and heads are attached to body by full double seams internally soldered.

3. Manufacture. (a) Seams soldered or full double seam. Outside surface rustproofed by lacquer or equivalent.

4. Test. (a) When closed as for shipment, must be capable of standing 40-pound interior pressure without leakage.

Specification 2P

INSIDE NON-REFILLABLE METAL CONTAINERS

1. Compliance. (a) Required in all details.

2. Type and size. (a) Single-trip inside containers. Must be seamless, or with seams, welded, soldered, brazed, double seamed, or swedged.

(b) The maximum capacity of containers in this class shall not exceed 50 cubic inches (28.8 fluid ounces). The maximum inside diameter shall not exceed 3 inches.

3. Inspection. (a) By competent inspector.

4. Duties of Inspector. (a) To inspect material and completed containers and witness tests, and to reject defective materials or containers.

5. Material. (a) Uniform quality steel plate such as black plate, electro-tin plate, hot dipped tin plate, tern plate or other commercially accepted can making plate; or non-ferrous metal of uniform drawing quality.

(b) Material with seams, cracks, laminations or other injurious defects not authorized.

6. Manufacture. (a) By appliances and methods that will assure uniformity of completed containers; dirt and scale to be removed as necessary; not defect acceptable that is likely to weaken the finished container appreciably; reasonably smooth and uniform surface finish required.

(b) Seams when used must be as follows:

(1) Circumferential seams: by welding, swedging, brazing, soldering, or double seaming.

(2) Side seams. by welding, brazing, or soldering.

(c) Ends. The ends shall be of pressure design.

7. Wall thickness. (a) the minimum wall thickness for any container shall be 0.007 inch.

8. Tests. (a) One out of each lot of 25,000 containers or less, successively produced per day shall be pressure tested to destruction and must not burst below 240 pounds per square inch gauge pressure. The container tested shall be complete with end assembled.

(b) Each such 25,000 containers or less, successively produced per day, shall constitute a lot and if the test container shall fail, the lot shall be rejected or ten additional containers may be selected at random and subjected to the test under which failure occurred. These containers shall be complete with ends assembled. Should any of the ten containers thus tested fail, the entire lot must be rejected. All containers constituting a lot shall be of like material, size, design, construction, finish and quality.

9. Marking. (a) On each container by printing, lithographing, embossing, or stamping "CTC 2P" and manufacturer's name or symbol. If symbol is used, it must be registered with the Bureau of Explosives through the Commission.

Specification 2Q

INSIDE NON-REFILLABLE METAL CONTAINERS

1. Compliance. (a) Required in all details.

2. Type and size. (a) Single-trip inside containers. Must be seamless, or with seams welded, soldered, brazed, double seamed, or swedged.

(b) The maximum capacity of containers in this class shall not exceed 50 cubic inches (28.8 fluid ounces). The maximum inside diameter shall not exceed 3 inches.

3. Inspection. (a) By competent inspector.

4. Duties of Inspector. (a) To inspect material and completed containers and witness tests, and to reject defective materials or containers.

5. Material. (a) Uniform quality steel plate such as black plate, electro tin plate, hot dipped tinplate, tern plate or other commercially accepted can making plate; or nonferrous metal uniform drawing quality.

(b) Material with seams, cracks, laminations or other injurious defects not authorized.

6. Manufacture. (a) By appliances and methods that will assure uniformity of completed containers; dirt and scale to be removed as necessary; no defect acceptable that is likely to weaken the finished container appreciably; reasonably smooth and uniform surface finish required.

(b) Seams when used must be as follows:

(1) Circumferential seams; by welding, swedging, brazing, soldering, or double seaming.

(2) Side seams. By welding, brazing or soldering.

(c) Ends. The ends shall be of pressure design.

7. Wall thickness. (a) The minimum wall thickness for any container shall be 0.008 inch.

8. Tests. (a) One out of each lot of 25,000 containers or less, successively produced per day, shall be pressure tested to destruction and must not burst below 270 pounds per square inch gauge pressure. The container tested shall be complete with end assembled.

(b) Each such 25,000 containers or less, successively produced per day, shall constitute a lot and if the test container shall fail, the lot shall be rejected or ten additional containers may be selected at random and subjected to the test under which failure occurred. These containers shall be completed with ends assembled. Should any of the ten containers thus tested fail, the entire lot must be rejected. All containers constituting a lot shall be of like material, size, design, construction, finish and quality.

9. Marking. (a) On each container by printing, lithographing, embossing, or stamping "CTC 2Q" and manufacturer's name or symbol. If symbol is used, it must be registered with the Bureau of Explosives through the Commission.

Specification 2R (Cancelled)

Specification 2S

POLYETHYLENE CONTAINER

Removable head containers not authorized.

1. Compliance. (a) Required in all details.

2. Material requirements. (a) Container shall be made of polyethylene and shall the following properties (see Note 1):

Melt index	2.6 maximum
Density	0.910—0.925
Tensile strength	1500 pounds per square inch minimum
Per cent elongation	400 per cent minimum

NOTE: 1: Properties to be obtained by a test method approved by the Commission or Bureau of Explosives. Other materials may be added which shall not affect the properties.

3. Construction, capacity and marking. (a) Container must be constructed in accordance with the following table:

Marked capacity not over (gallons)[1]	Maximum capacity (gallons)	Minimum thickness: Side wall and heads (inches)[2]	Minimum weight (pounds)
4	5	0.0625	1.4
11	12	0.0625	3.25
12	13	0.0625	3.5
24	25.5	0.0625	5.5
44	46	0.0625	9

[1] Marked capacity shall be minimum capacity.
[2] Side openings are not authorized.

(b) Marking. Each container must be permanently marked to show minimum capacity, month and year of manufacture, maker (symbols if used, must be registered with the Bureau of Explosives through the Commission) and CTC-2S in figures and letters at least ¼ inch in size.

(c) Polyethylene container must fit snugly in outside container.

4. Closures. (a) Closing devices must be of screw thread type or fastened by positive means and be of material resistant to the lading and adequate to prevent leakage.

(b) Openings over 2.3 inches in diameter not permitted.

5. Tests. (a) Samples taken at random, empty or filled, and prepared as specified and closed as for use, shall be capable of withstanding the following tests without breakage or leakage:

(1) Empty container shall be dropped on any part from a height of 6 feet onto solid concrete, immediately after conditioning for at least 24 hours at 0°F.

(2) The polyethylene container in a prescribed outer specification container, as authorized by Part 73, filled to 98 per cent of capacity with water shall be dropped from a height of 4 feet onto solid concrete so as to drop diagonally on top edge or any part considered weaker.

(3) The polyethylene container in a prescribed outer specification container, as authorized by Part 73, filled to 98 per cent of capacity with a solution which is compatible

with polyethylene and remains liquid at 0°F. shall be dropped from a height of 4 feet onto solid concrete on any part of the container when container and contents are at or slightly below 0°F.

(4) The polyethylene container in a prescribed outer specification container, as authorized in Part 73, filled to 98 per cent of capacity with water shall be capable of withstanding a vibration test by placing the container on the vibration table anchored in such manner that all horizontal motion shall be restricted and only vertical motion allowed. The test shall be performed for one hour using an amplitude of one inch at a frequency that causes the test container to be raised from the floor of the table to such a degree that a piece of paper or flat steel strap or tape can be passed between the table and the container.

Specification 2SL

MOLDED OR THERMOFORMED POLYETHYLENE CONTAINERS

Removable heads container or containers fabricated from film not authorized.

1. Material requirements. (a) Container shall be made of polyethylene and have the following properties (see Note 1):

Melt index	2.6 maximum
Density	0.910—0.925
Tensile strength	1500 pounds per square inch minimum
Per cent elongation	400 per cent minimum

NOTE 1: Properties to be obtained by a test method approved by the Commission or the Bureau of Explosives. Other materials may be added which shall not affect the properties of this section.

2. Construction, capacity and marking. (a) Container must be constructed in accordance with the following table:

Marked capacity not over (gallons)[1]	Maximum capacity (gallons)	Minimum thickness: Side wall and heads (inches)[2]	Minimum weight (pounds)
11	12	0.030	2
12	13	0.030	2.25
24	25.5	0.030	3.25
44	46	0.040	5

[1] Marked (actual) capacity shall be minimum capacity.
[2] Side openings are not authorized.

(b) Closure. Closure shall be of material resistant to lading and adequate to prevent leakage. Vented closures where specified under Part 73 are authorized. No opening over 2.3 inches in diameter authorized.

(c) Marking. Each container must be permanently marked to show minimum capacity, month and year of manufacture, maker (symbols, if used, must be registered with the Bureau of Explosives through the Commission) and CTC-2SL in figures and letters at least ¼ inch in size.

(d) Polyethylene container must fit snugly in outside container.

3. Type test. (a) Samples taken at random shall withstand prescribed test without breakage. Test shall be made on each type and size at each manufacturing location starting production and shall be repeated every four months. The type test is as follows:

(1) Empty container shall be dropped on any part from a height of 6 feet onto solid concrete immediately after conditioning for at least 24 hours at 0°F.

4. Tests. (a) Samples taken at random, filled and prepared as specified and closed as for use, shall be capable of withstanding the following tests without leakage:

(1) The polyethylene container in a prescribed outer specification container, as authorized by Part 73, filled to 98 per cent of capacity with water shall be dropped from a height of 4 feet onto solid concrete so as to drop diagonally on top edge or any part considered weaker.

(2) The polyethylene container in a prescribed outer specification container, as authorized by Part 73, filled to 98 per cent of capacity with a solution which is compatible with polyethylene and remains liquid ot 0°F. shall be dropped from a height of 4 feet onto solid concrete on any part of the container when container and contents are at or slightly below 0°F.

(3) The polyethylene container in a prescribed outer specification container, as authorized in Part 73, filled to 98 per cent of capacity with water shall be capable of withstanding a vibration test by placing the container on the vibration table anchored in such manner that all horizontal motion shall be restricted and only vertical motion allowed. The test shall be performed for one hour using an amplitude of one inch at a frequency that causes the test container to be raised from the floor of the table to such a degree that a piece of paper or flat steel strap or tape can be passed between the table and the container.

Specification 2T

POLYETHYLENE CONTAINERS

1. Compliance. (a) Required in all details.

2. Capacity and marking of container. (a) Containers 5 to 11 gallons capacity are covered by this specification. Actual capacity must be the marked capacity plus 5 per cent minimum. Must be permanently marked to indicate marked capacity, maker (symbols, if used, must be registered with the Bureau of Explosives through the Commission), month and year of manufacture, and CTC-2T in figures and letters at least ¼ inch high.

3. Material. (a) Containers shall be made of polyethylene and shall have the following properties (see Note 1).

Melt index	2.6 maximum
Density	0.910—0.925
Tensile strength	1500 pounds per square inch minimum
Per cent elongation	400 per cent minimum

NOTE 1: Properties to be obtained by a test method approved by the Commission or the Bureau of Explosives. Other materials may be added which shall not affect the properties specified in paragraph (a) of this section.

(1) Container must have a minimum weight and wall thickness in accordance with the following table:

Marked capacity not over (gallons)	Minimum wall thickness (inch)	Minimum weight of containers (pounds)
5	0.0625	3
5 1/2	0.0625	4
11	0.0625	8

(b) Closing device shall be of material resistant to the lading and adquate to prevent leakage and not over 3½ inches in diameter.

(c) Tests. Samples taken at random, empty or filled, and prepared as specified and closed as for use, shall be capable of withstanding the following tests without breakage or leakage:

(1) Empty container shall be dropped on any part from a height of 6 feet onto solid concrete, immediately after conditioning for at least 24 hours at 0°F.

(2) The polyethylene container in a prescribed outer specification container, as authorized by Part 73, filled to 98 per cent of capacity with water shall be dropped from a height of 4 feet onto solid concrete so as to drop diagonally on top edge or any part considered weaker.

(3) The polyethylene container in a prescribed outer specification container, as authorized by Part 73, filled to 98 per cent of capacity with a solution which is compatible with polyethylene and remains liquid at 0°F. shall be dropped from a height of 4 feet onto solid concrete on any part of the container when container and contents are at or slightly below 0°F.

(4) The polyethylene container in a prescribed outer specification, as authorized in Part 73, filled to 98 per cent of capacity with water shall be capable of withstanding a vibration test by placing the container on the vibration table anchored in such manner that all horizontal motion shall be restricted and only vertical motion allowed. The test shall be performed for one hour using an amplitude of one inch at a frequency that causes the test container to be raised from the floor of the table to such a degree that a piece of paper or flat steel strap or tape can be passed between the table and the container.

(d) Polyethylene container must fit snugly in outside container.

Specification 2TL

POLYETHYLENE CONTAINERS

1. Material requirements. (a) Container shall be made of polyethylene and shall have the following properties (see Note 1):

Melt index	2.6 maximum
Density	0.910—0.925
Tensile strength	1500 pounds per square inch minimum
Per cent elongation	400 per cent minimum

NOTE 1: Properties to be obtained by a test method approved by the Commission or Bureau of Explosives. Other materials may be added which shall not affect the properties specified in paragraph (a) of this section.

2. Construction, capacity and marking. (a) Container must be constructed in accordance with the following table:

Marked capacity[1] not over (gallons)	Minimum wall thickness (inches)	Minimum weight of containers (pounds)
5	0.015	1
11 1 2	0.050	5 1 2

[1] Actual capacity must be the marked capacity plus 5 per cent minimum.

(b) Closure. Closure shall be of material resistant to lading and adequate to prevent leakage. Vented closures where specified under Part 73 authorized. No opening over 3½ inches in diameter authorized.

(c) Marking. Each container must be permanently marked to show the rated (marked) capacity, month and year of manufacture, maker (symbols, if used, must be registered with the Bureau of Explosives through the Commission) and CTC-2TL in figures and letters at least ¼ inch in size.

(d) Polyethylene container must fit snugly in outside container.

3. Type test. (a) Samples taken at random shall withstand prescribed test without breakage. Test shall be made on each type and size at each manufacturing location starting production and shall be repeated every four months. The type test is as follows:

(1) Empty container shall be dropped on any part from a height of 6 feet onto solid concrete, immediately after conditioning for at least 24 hours at 0°F.

4. Tests. (a) Samples taken at random, filled and prepared as specified and closed as for use, shall be capable of withstanding the following tests without leakage:

(1) The polyethylene container in a prescribed outer specification container as authorized by Part 73, filled to 98 per cent capacity with water shall be dropped from a height of 4 feet onto solid concrete so as to drop diagonally on top edge or on any part considered weaker.

(2) The polyethylene container in a prescribed outer specification container, as authorized by Part 73, filled to 98 per cent capacity with a solution which is compatible with polyethylene and remains liquid at 0°F. shall be dropped from a height of 4 feet onto solid concrete on any part of the container when container and contents are at or slightly below 0°F.

(3) The polyethylene container in a prescribed outer specification container, as authorized in Part 73, filled to 98 per cent of capacity with water shall be capable of withstanding a vibration test by placing the container the container on the vibration table anchored in such manner that all horizontal motion shall be restricted and only vertical motion allowed. The test shall be performed for one hour using an amplitude of one inch at a frequency that causes the test container to be raised from the floor of the table to such a degree that a piece of paper or flat steel strap or tape can be passed between the table and the container.

Specification 2U

MOLDED OR THERMO-FORMED POLYETHYLENE CONTAINERS

Removable head containers or containers fabricated from film not authorized

1. Compliance. (a) Required in all details.

2. Material. (a) Containers shall be made of polyethylene and shall have the following properties (see Note 1):

Melt index	2.6 maximum
Density	0.910-0.925
Tensile strength	1500 pounds per square inch minimum
Per cent elongation	400 per cent minimum

NOTE 1: Properties to be obtained by a test method approved by the Commission or the Bureau of Explosives. Other materials may be added which shall not affect the properties specified in paragraph (a) of this section.

NOTE 2: Type III polyethylene, as specified in Appendix B, is authorized for containers up to 5 gallons marked capacity (5½ gallons maximum capacity).

3. Construction and capacity. (a) Container must be constructed in accordance with the following table:

Rated capacity not over (gallons)	Minimum overall thickness (inch)[1]	Per cent outage over marked capacity permitted
5	0.010	15
12 1/2	0.015	15
46	0.015	5

[1] For cubical containers, the area adjacent to and forming the opening for closure may have a minimum thickness of 0.008 inch for 5 gallons rated capacity and sizes larger than 5 gallons may have a minimum thickness of 0.010 inch.

(b) Polythylene container must fit snugly in outside container.

4. Closure. (a) Shall be of material resistant to lading and adequate to prevent leakage. Vented closures where specified under these regulations authorized. No opening over 2.7 inches in diameter authorized.

5. Marking. (a) Each container must be permanently marked by embossment to show rated capacity, month and year of manufacture, maker (symbols, if used, must be registered with the Bureau of Explosives through the Commission) and CTC-2U in figures and letters at least ¼ inch in size.

6. (Cancelled).

7. Tests. (a) Samples taken at random shall withstand prescribed tests without breakage or leakage. Tests shall be made on each type and size at each manufacturing location starting production and shall be repeated every four months. The type tests are as follows:

(1) The polyethylene container in a prescribed outer specification container, as authorized by these regulations, filled to 98 per cent of capacity with water shall be dropped from a height of 4 feet onto solid concrete so as to drop diagonally on top edge or any part considered weaker.

(2) The polyethylene container in a prescribed outer specification container, as authorized by these regulations filled to 98 per cent of capacity with a solution which is compatible with polyethylene and remains liquid at 0°F. shall be dropped from a height of 4 feet onto solid concrete on any part of the container when container and contents are at or slightly below 0°F.

(3) The polyethylene container in a prescribed outer specification container, as authorized in these regulations, filled to 98 per cent of capacity with water shall be capable of withstanding a vibration test by placing the container on the vibration table anchored in such manner that all horizontal motion shall be restricted and only vertical motion allowed. The test shall be performed for one hour using an amplitude of one inch at a frequency that causes the test container to be raised from the floor of the table to such a degree that a piece of paper or flat steel strap of tape can be passed between the table and the container.

SPECIFICATION 3A
SEAMLESS STEEL CYLINDERS
or
Specification 3AX
SEAMLESS STEEL CYLINDERS

of capacity over 1000 pounds water volume.

1. Compliance. (a) Required in all details.

2. Type, size and service pressure.[1] (a) CTC-3A; seamless, not over 1,000 pounds water capacity (nominal) and service pressure at least 150 pounds per square inch.

(b) CTC-3AX; seamless, not less than 1,000 pounds water capacity and service pressure at least 500 pounds per square inch. Cylinders shall meet the following additional conditions:

(1) Assuming the cylinder to be supported horizontally at its two ends only and to be uniformly loaded over its entire length consisting of the weight per unit of length of the straight cylindrical portion filled with water and compressed to the specified test pressure; the sum of two times the maximum tensile stress in the bottom fibres due to bending (Note 1), plus that in the same fibres (longitudinal stress) (Note 2), due to hydrostatic test shall not exceed 80 per cent of the minimum yield strength of the steel at such maximum stress. Wall thickness shall be increased when necessary to meet the requirement.

NOTE 1: To calculate the maximum tensile stress due to bending, the following formula shall be used:

$$S = \frac{Mc}{I}$$

[1] The "Service pressure" limits the use of the cylinder. It is shown by marks on cylinders; for example CTC-3A 2000 indicates the service pressure as 2000 pounds per square inch.

NOTE 2: To calculate the maximum longitudinal tensile stress due to hydrostatic test pressure, the following formula shall be used:

$$S = \frac{A_1 P}{A_2}$$

where:

S = tensile stress—psi;

M = bending moment—inch pounds $\frac{(wl^2)}{8}$;

w = weight per inch of cylinder filled with water;

l = length of cylinder—inches;

c = radius $\frac{(D)}{(2)}$ of cylinder—inches;

I = moment of inertia—$0.04909\ (D^4-d^4)$ inches fourth;

D = outside diameter—inches;

d = inside diameter—inches;

A_1 = internal area in cross section of cylinder—square inches;

A_2 = area of metal in cross section of cylinder—square inches;

P = hydrostatic test pressure—psi.

3. Inspection by whom and where. By competent and independent Inspector approved by the Canadian Transport Commission. For cylinders not made in Canada, or the United States of America, the tests, as specified, shall be made within the limits of Canada, unless written permission is obtained from the Commission to conduct the tests elsewhere.

4. Duties of inspector. (a) Inspect all material and reject any not complying with requirements; for cylinders made by billet-piercing process, billets to be inspected after parting and shown to be free from pipe, cracks, excessive segregation and other injurious defects.

(b) Verify chemical analysis of each heat of material by analysis or by obtaining certified analysis: Provided, That a certificate from the manufacturer thereof, giving sufficient data to indicate compliance with requirements, is acceptable when verified by check analyses of samples taken from one cylinder out of each lot of 200 or less.

(c) Verify compliance of cylinders with all requirements indluding makings; inspect inside before closing in both ends; verify heat treatment as proper; obtain samples for all tests and check chemical analyses; witness all tests; verify threads by gauge; report volumetric capacity and tare weight (see report form) and minimum thickness of wall noted.

(d) Render complete report required by this specification to cylinder maker, Canadian Transport Commission and upon request to the purchaser.

5. Steel. (a) Open-heart or electric steel of uniform quality. Content per cent for the following not over: Carbon, 0.55; phosphorus, 0.045; sulphur, 0.050.

6. Identification of material. (a) Required; any suitable method except that plates and billets for hot-drawn cylinders shall be marked with heat number.

7. Defects. (a) Material with seams, cracks, laminations, or other injurious defects, not authorized.

8. Manufacture. (a) By best appliances and methods; dirt and scale to be removed as necessary to afford proper inspection; no fissure or other defect acceptable that is likely to weaken the finished cylinder appreciably; reasonably smooth and uniform surface finish required. If not originally free from such defects, the surface may be machined or otherwise treated to eliminate these defects. The thickness of the bottoms of cylinders welded or formed by spinning is, under no condition, to be less than two times the minimum wall thickness of the cylindrical shell; such bottom thicknesses to be measured within an area bounded by a line representing the points of contact between the cylinder and floor when the cylinder is in a vertical position.

9. Welding or brazing. (a) Welding or brazing for any purpose whatsoever is prohibited except as follows: (1) Welding or brazing is authorized for the attachment of neckrings and footrings which are nonpressure parts, and only to the tops and bottoms of cylinders having a service pressure of 500 pounds per square inch or less. Cylinders, neckrings, and footings must be made of weldable steel, carbon content of which must not exceed 0.25 per cent except in the case of 4130X steel which may be used with proper welding procedure. (2) As permitted in sect. 8 (a).

NOTE 1: Cylinders used solely in anhydrous ammonia service may have a ½ inch diameter bar welded within their concave bottoms is accordance with the foregoing requirements.

10. Wall thickness. (a) For cylinders with service pressure less than 900 pounds the wall stress shall not exceed 24,000 pounds per square inch. Minimum wall 0.100" for any cylinder over 5" outside diameter.

(b) Calculation must be made by the formula:

$$S = \frac{P\ (1.3D^2 + 0.4d^2)}{D^2 - d^2}$$

where:

S = wall stress in pounds per square inch;

P = minimum test pressure prescribed for water-jacket test or 450 pounds per square inch whichever is the greater;

D = outside diameter in inches;

d = inside diameter in inches.

11. Heat treatment. (a) The completed cylinders must be uniformly and properly heat-treated prior to tests.

12. Openings in cylinders and connections (valves, fuse plugs, etc.) for those openings. (a) Threads required, to be clean cut, even, without checks, and to gauge.

(b) Taper threads, when used, to be of length not less than as specified for American Standard taper pipe threads.

(c) Straight threads having at least 6 engaged threads are authorized; to have tight fit and calculated shear strength at least 10 times the test pressure of the cylinder; gaskets required, adequate to prevent leakage.

13. Safety devices and protection for valves, safety devices, and other connections, if applied. (a) Must be as required by these regulations that apply (see secs. 73.34(d) and 73.301(g)).

14. Hydrostatic test. (a) By water-jacket, or other suitable method, operated so as to obtain accurate data. Pressure gauge must permit reading to accuracy of 1 per cent. Expansion gauge must permit reading ot total expansion to accuracy either of 1 per cent or 0.1 cubic centimetre.

(b) Pressure must be maintained for 30 seconds and sufficiently longer to insure complete expansion. Any internal pressure applied after heat-treatment and previous to the official test must not exceed 90 per cent of the test pressure. If, due to failure of the test apparatus, the test pressure cannot be maintained, the test may be repeated at a pressure increased by 10 per cent or 100 pounds per square inch, whichever is the lower.

(c) Permanent volumetric expansion must not exceed 10 per cent of total volumetric expansion at test pressure.

(d) Each cylinder must be tested to at least 5/3 times service pressure.

15. Flattening test. (a) Between knife edges, wedge shaped, 60° angle, rounded to ½″ radius; test 1 cylinder,[1] taken at random out of each lot of 200 or less, after hydrostatic test.

16. Physical test. (a) To determine yield strength, tensile strength, elongation, and reduction of area of material. Required on 2 specimens cut from 1[1] cylinder taken at random out of each lot of 200 or less.

(b) Specimens must be: Gauge length 8 inches width not over 1½ inches; or, gauge length 2 inches with width not over 1½ inches; provided, that gauge length at least 24 times thickness with width not over 6 times thickness is authorized when cylinder wall is not over 3/16-inch thick. The specimen, exclusive of grip ends, must not be flattened. Grip ends may be flattened to within 1 inch of each end of the reduced section. When size of cylinder does not permit securing straight specimens, the specimens may be taken in any location or direction and may be straightened or flattened cold, by pressure only, not by blows; when specimens are so taken and prepared, the inspector's report must show in connection with record of physical tests detailed information in regard to such specimens. Heating of specimen for any purpose is not authorized.

(c) The yield strength in tension shall be the stress corresponding to a permanent strain of 0.2 per cent of the gauge length.

(1) The yield strength shall be determined by either the "offset" method or the "extension under load" method as prescribed in ASTM Standard E8-57T.

(2) In using the "extension under load" method, the total strain (or "extension under load") corresponding to the stress at which the 0.2 per cent permanent strain occurs may be determined with sufficient accuracy by calculating the elastic extension of the gauge length under appropriate load and adding thereto 0.2 per cent of the gauge length. Elastic extension calculations shall be based on an elastic modulus of 30,000,000. In the event of controversy, the entire stress-strain diagram shall be plotted and the yield strength determined from the 0.2 per cent offset.

(3) For the purpose of strain measurement, the initial strain shall be set while the specimen is under a stress of 12,000 pounds per square inch, the strain indicator reading being set at the calculated corresponding strain.

(4) Cross-head speed of the testing machine shall not exceed ⅛ inch per minute during yield strength determination.

17. Acceptable results for physical and flattening tests. (a) Either of the following:

(1) Elongation at least 40 per cent for 2-inch gauge length or at least 20 per cent in other cases; yield strength not over 73 per cent of tensile strength; flattening test not required.

(2) Elongation at least 20 per cent for 2-inch gauge length or 10 per cent in other cases; yield strength not over 73 per cent of tensile strength; flattening required, without cracking, to 6 times wall thickness.

18. Leakage test. (a) All spun cylinders and plugged cylinders (see Notes 1 and 2) must be tested for leakage by gas or air pressure after the bottom has been cleaned and is free from all moisture. Pressure, approximately the same as but no less than service pressure, must be applied to one side of the finished bottom over an area of at least 1/16 of the total area of the bottom but not less than ¾ inch in diameter, including the closure, for at least 1 minute, during which time the other side of the bottom exposed to pressure must be covered with water and closely examined for indications of leakage. Leakers must be rejected. (See Note 1 to sec. 19.)

NOTE 1: A spun cylinder is one in which as end closure in the finished cylinder has been welded by the spinning process.

NOTE 2: A plugged cylinder is one in which a permanent closure in the bottom of a finished cylinder has been effected by a plug.

NOTE 3: As a safety precaution, if the manufacturer elects to make this test before the hydrostatic test, he should design his aparatus so that the pressure is applied to the smallest area practicable, around the point of closure, and so as to use the smallest possible volume of air or gas.

19. Rejected cylinders. (a) Reheat treatment authorized; subsequent thereto, acceptable cylinders must pass all prescribed tests. Repair by welding or spinning is not authorized.

NOTE 1: Spun cylinders rejected under the provisions of sec. 18 may be removed from the spun cylinder category by drilling to remove defective material, tapping and plugging.

20. Marking. (a) Marking on each cylinder by stamping plainly and permanently on shoulder, top head, or neck as follows:

(1) When cylinders are constructed to para. 2(a), they shall be marked CTC-3A followed by the service pressure (for example, CTC-3A1800, etc.).

(2) When cylinders are constructed to para. 2(b), they shall be marked CTC-3AX followed by the service pressure (for example, CTC-3AX1800, etc.).

(3) A serial[3] number and an identifying symbol (letters); location[4] of number to be just below or immediately following the CTC mark; location[4] of symbol to just below or immediately following the number. The symbol and numbers must be those of purchaser, user, or marker. The symbol must be registered with the Bureau of Explosives

[1] For lots of 30 or less, physical and flattening tests are authorized to be made on a ring at least 8 inches long cut from each cylinder and subjected to same heat treatment as the finished cylinder.

[3] Lot numbers, not over 500 cylinders in each lot, authorized or cylinders not over 2 inches outside diameter and for cylinders over 2 inches outside diameter when the volumetric capacity does not exceed 60 cubic inches.

[4] Symbol in front of or following the number with ample space between is also authorized. Other variation in location authorized only when necessitated by lack of space.

through the Canadian Transport Commission, duplications unauthorized.

Examples: CTC-8A1800 CTC-3A1800-1234-XY
1234
XY

NOTE 1: Specification cylinders may be marked BTC or CTC; newly manufactured cylinders shall be marked CTC.

(4) Inspector's official mark near serial number; date of test (such as 5-50 for May 1950), so placed that dates of subsequent tests can be easily added; and word "SPUN" or "PLUG" near mark when an end closure in the finished cylinder has been welded by the spinning process, or effected by plugging.

21. Size of marks. (a) At least ¼" high if space permits.

22. Inspector's report. (a) Required to be clear, legible, and in following form:

(Place)

(Date)

Gas Cylinders
Manufactured for Company
Location at
Manufactured by Company
Location at
Consigned to Company
Location at
Quantity
Size . . inches outside diameter by inches long.

Marks stamped into the shoulder of the cylinder are:
Specification CTC—
Serial numbers to inclusive.
Inspector's mark
Identifying symbol (registered)
Test date
Tare weights (yes or no)
Other marks (if any)
These cylinders were made by process of

The permitted in
(neckrings—footrings)
Sec. 9 were attached by process of

(welding—brazing)
The material used was identified by the following
(heat-purchase order)
numbers

The material used was verified as to chemical analysis and record thereof is attached hereto. The heat numbers
(were—were not)
marked on the material.

All material, such as plates, billets and seamless tubing, was inspected and each cylinder was inspected both before and after closing in the ends; all that was accepted was found free from seams, cracks, laminations, and other defects which might prove injurious to the strength of the cylinder. The processes of manufacture and heat treatment of cylinders were supervised and found to be efficient and satisfactory.

The cylinder walls were measured and the minimum thickness noted was inch. The outside diameter was determined by a close approximation to be . . inches. The wall stress was calculated to be pounds per square inch under an internal pressure of pounds per square inch.

Hydrostatic tests, flattening tests, tests of material, and other tests, as prescribed in specification No. CTC-8A were made in the presence of the inspector and all material and cylinders accepted were found to be in compliance with the requirements of that specification. Records thereof are attached hereto.

I hereby certify that all of these cylinders proved satisfactory in every way and comply with the requirements of the Canadian Transport Commission specification No. 3A except as follows:

Exceptions:

(Signed)
Inspector.
(Place)
(Date)

RECORD OF CHEMICAL ANALYSIS OF MATERIAL FOR CYLINDERS

Numbered to inclusive.
Size inches outside diameter by inches long.
Made by Company
For Company

NOTE: Any omission of analyses by heats, if authorized, must be accounted for by notation hereon reading "The prescribed certificate of the manufacturer of material has been secured, found satisfactory, and placed on file," or by attaching a copy of the certificate.

Test No.	Heat No.	Check analysis No.	Cylinders represented Serial Nos.)	Chemical analysis						
				C	P	S	Si	Mn	Ni	Cr

The analyses were made by
(Signed)
(Place)
(Date)

RECORD OF PHYSICAL TESTS OF MATERIALS FOR CYLINDERS

Numbered to inclusive.
Size inches outside diameter by inches long.
Made by Company
For Company

Test No.	Cylinders represented by test (Serial Nos.)	Yield strength (pounds per square inch)	Tensile strength (pounds per square Inch)	Elongation (per cent in 8 inches	Reductions of area (per cent)	Flattening test

(Signed)
(Place)
(Date)

RECORD OF HYDROSTATIC TESTS ON CYLINDERS

Numbered to inclusive.
Size inches outside diameter by inches long.
Made by Company
For Company

Serial numbers of cylinders tested arranged numerically	Actual test pressure (pounds per square inch)	Total expansion (cubic centimetres)[1]	Permanent expansion (cubic centimetres)[1]	Per cent ratio of permanent expansion to total expansion[2]	Tare weight (pounds)[2]	Volumetric capacity

[1] If the tests are made by a method involving the measurement of the amount of liquid forced into the cylinder by the test pressure, then the basic data, on which the calculations are made, such as the pump factors, temperature of liquid, coefficient of compressibility of liquid, etc., must also be given.

[2] Do not include removable cap but state, whether with or without valve. These weights must be accurate to a tolerance of 1 per cent.

(Signed)

Specification 3AA
SEAMLESS STEEL CYLINDERS

Made of definitely prescribed steels.

or

Specification 3AAX
SEAMLESS STEEL CYLINDERS

Made of definitely prescribed steels of capacity over 1000 pounds water volume.

1. Compliance. (a) Required in all details.

2. Type, size and service pressure[1]. (a) CTC-3AA; seamless, not over 1,000 pounds water capacity (nominal) and service pressure at least 150 pounds per square inch.

(b) CTC-3AAX; seamless, not less than 1,000 pounds water capacity and service pressure at least 500 pounds per square inch. Cylinders shall meet the following additional conditions:

(1) Assuming the cylinder to be supported horizontally at its two ends only and to be uniformly loaded over its entire length consisting of the weight per unit of length of the straight cylindrical portion filed with water and compressed to the specified test pressure; the sum of two times the maximum tensile stress in the bottom fibres due to bending (Note 1), plus that in the same fibres (longtidinal stress) (Note 2), due to hydrostatic test shall not exceed 80 per cent of the maximum yield strength of the steel at such maximum stress. Wall thickness shall be increased when necessary to meet the requirement.

NOTE 1: To calculate the maximum tensile stress due to bending, the following formula shall be used:

$$S = \frac{Mc}{I}$$

NOTE 2: To calculate the maximum longitudinal tensile stress due to hydrostatic test pressure, the following formula shall be used:

$$S = \frac{A_1 P}{A_2}$$

where:

S = tensile stress—psi;

M = bending moment—inch pounds $\frac{(wl^2)}{8}$;

w = weight per inch of cylinder filled with water;

l = length of cylinder—inches;

c = radius $\frac{(D)}{(2)}$ of cylinder—inches;

I = moment of inertia—0.04909 (D^4–d^4) inches fourth;

D = outside diameter—inches;

d = inside diameter—inches;

A_1 = internal area in cross section of cylinder—square inches;

A_2 = area of metal in cross section of cylinder—square inches;

P = hydrostatic test pressure—psi.

[1] The "service pressure" limits the use of the cylinder. It is shown by marks on cylinder; for example, CTC-3AA2000 indicates the service pressure as 2,000 pounds per square inch.

3. Inspection by whom and where. By competent and independent Inspector approved by the Canadian Transport Commission. For cylinders not made in Canada, or the United States of America, the tests, as specified, shall be made within the limits of Canada, unless written permission is obtained from the Commission to conduct the tests elsewhere.

4. Duties of inspector. (a) Inspect all material and reject any not complying with requirements; for cylinders made by billet-piercing process, billets to be inspected after parting and shown to be free from pipe, cracks, excessive segregation and other injurious defects.

(b) Verify chemical analysis of each heat of material by analysis or by obtaining certified analysis: Provided, That a certificate from the manufacturer thereof, giving sufficient data to indicate compliance with requirements, is acceptable when verified by check analyses of samples taken from one cylinder out of each lot of 200 or less.

(c) Verify compliance of cylinders with all requirements including markings; inspect inside before closing in both ends; verify heat treatment as proper; obtain samples for all tests and check chemical analyses; witness all tests; verify threads by gauge; report volumetric capacity and tare weight (see report form) and minimum thickness of wall noted.

(d) Render complete report required by this specification to cylinder maker, Canadian Transport Commission and upon request to the purchaser.

5. Authorized steel. (a) Open-hearth, basic oxygen, or electric steel of uniform quality. The following chemical analyses are authorized (see Note 1):

Designation	4130X (per cent) (see note 2)	NE-8630 (per cent) (see note 2)	9115 (per cent) (see note 2)	9125 (per cent) (see note 2)
Carbon	0.25/0.35	0.28/0.33	0.10/0.20	0.20 0.30
Manganese	0.40/0.90	0.70/0.90	0.50 0.75	0.50 0.75
Phosphorus	0.04 max.	0.04 max.	0.04 max.	0.04 max.
Sulphur	0.05 max.	0.04 max.	0.04 max.	0.04 max.
Silicon	0.20 0.35	0.20/0.35	0.60 0.90	0.60 0.90
Chromium	0.80 1.10	0.40/0.60	0.50 0.65	0.50/0.65
Molybdenum	0.15/0.25	0.15/0.25	.....	.....
Zirconium	.....	.....	0.05/0.15	0.05 0.15
Nickel	.....	0.40/0.70	.....	.....

Designation	9115X (per cent) (see note 2)	9125X (per cent) (see note 2)	Intermediate manganese (per cent)
Carbon	0.10 0.20	0.20 0.30	0.40 max.
Manganese	0.50 0.75	0.50/0.75	1.35 1.65
Phosphorus	0.04 max.	0.04 max.	0.04 max.
Sulphur	0.04 max.	0.04 max.	0.05 max.
Silicon	0.60 0.90	0.60 0.90	0.10 0.30
Chromium	0.50 0.65	0.50 0.65	.....
Molybdenum	0.10/0.20	0.10 0.20	.....
Zirconium	0.05 0.15	0.05 0.15	.....
Nickel	.....	.....	.....

Note 1: A heat of steel made under the above specifications, check chemical analysis of which is slightly out of the specified range, is acceptable if satisfactory in all other respects, provided the tolerances shown in the following table are not exceeded except as approved by the Commission.

CHECK ANALYSIS TOLERANCES

Element	Limit or maximum specified (per cent)	Tolerance (per cent) over the maximum limit or under the minimum limit	
		Under minimum limit	Over maximum limit
Carbon	To 0.15 incl.	0.02	0.03
	Over 0.15 to 0.40 incl.	0.03	0.04
Manganese	To 0.60 incl.	0.03	0.03
	Over 0.60 to 1.15 incl.	0.04	0.04
	Over 1.15 to 2.50 incl.	0.05	0.05
Phosphorus[1]	All ranges		0.01
Sulphur	All ranges		0.01
Silicon	To 0.30 incl.	0.02	0.03
	Over 0.30 to 1.00 incl.	0.05	0.05
Nickel	To 1.00 incl.	0.03	0.03
Chromium	To 0.90 incl.	0.03	0.03
	Over 0.90 to 2.10 incl.	0.05	0.05
Molybdenum	To 0.20 incl.	0.01	0.01
	Over 0.20 to 0.40 incl.	0.02	0.02
Zirconium	All ranges	0.01	0.05

[1] Rephosphorized steels not subject to check analysis for phosphorus.
[2] Note 2: This designation shall not be restrictive and the commercial steel is limited to analysis as shown in the table.
Note 3: (Cancelled).

6. Identification of material. (a) Required; any suitable method except that plates and billets for hot-drawn cylinders shall be marked with heat number.

7. Defects. (a) Material with seams, cracks, laminations, or other injurious defects, not authorized.

8. Manufacture. (a) By best appliances and methods; dirt and scale to be removed as necessary to afford proper inspection; no fissure or other defect acceptable that is likely to weaken the finished cylinder appreciably; reasonably smooth and uniform surface finish required. If not originally free from such defects, the surface may be machined or otherwise treated to eliminate these defects. The thickness of the bottoms of cylinders welded or formed by spinning is, under no condition, to be less than two times the minimum wall thickness of the cylindrical shell; such bottom thicknesses to be measured within an area bounded by a line representing the points of contact between the cylinder and floor when the cylinder is in a vertical position.

9. Welding or brazing. (a) Welding or brazing for any purpose whatsoever is prohibited except as follows:

(1) Welding or brazing is authorized for the attachment of neckrings and footrings which are nonpressure parts, and only to the tops and bottoms of cylinders having a service pressure of 500 pounds per square inch or less. Cylinders, neckrings, and footrings must be made of weldable steel, carbon content of which must not exceed 0.25 per cent except in the case of 4130X steel which may be used with proper welding procedure.

(2) As permitted in sec. 8.

10. Wall thickness. (a) For cylinders with service pressure less than 900 pounds the wall stress shall not exceed 24,000 pounds per square inch. Minimum wall 0.100" for any cylinder over 5" outside diameter.

(b) For cylinders with service pressure of 900 psi. or more the minimum wall shall be such that the wall stress at the minimum specified test pressure shall not exceed 67 per cent of the minimum tensile strength of the steel as determined from the physical tests required in secs. 16 and 17 and shall be not over 70,000 psi.

(c) Calculation must be made by the formula:

$$S = \frac{P\,(1.3D^2 + 0.4d^2)}{D^2 - d^2}$$

where:

S = wall stress in pounds per square inch;
P = minimum test pressure prescribed for water-jacket test or 450 pounds per square inch whichever is the greater;
D = outside diameter in inches;
d = inside diameter in inches.

11. Heat treatment. (a) The completed cylinders must be uniformly and properly heat treated prior to tests. Heat treatment of cylinders of the authorized analyses shall be as follows:

(1) All cylinders must be quenched by oil, or other suitable medium except as provided in subparagraph (5) of this paragraph.

(2) The steel temperature on quenching shall be that recommended for the steel analysis, but in no case shall exceed 1750°F.

(3) All steels shall be tempered at a temperature most suitable for that steel.

(4) The minimum tempering temperature shall be not less than 1000°F. except as noted in paragraph (a)(6) of this section.

(5) Steel 4130X may be normalized at a temperature of 1650°F. instead of being quenched, and cylinders so normalized need not be tempered.

(6) Intermediate manganese steels may be tempered at temperatures not less than 1150°F., and after heat treating, each cylinder must be submitted to a magnetic test to detect the presence of quenching cracks. Cracked cylinders shall be rejected and destroyed.

(7) (Cancelled).

(8) Except as otherwise provided in subparagraph (6) of this paragraph, all cylinders, if water quenched or quenched with a liquid producing a cooling rate in excess of 80 per cent of the cooling rate of water, must be inspected by the magnetic particle, dye penetrant or ultrasonic method to detect the presence of quenching cracks. Any cylinder designed to the requirements for specification 3AA and found to have a quenching crack must be rejected and may not be requalified. Cylinders designed to the requirements for specification 3AAX and found to have cracks must have cracks removed to sound metal by mechanical means. Such specification 3AAX cylinders will be acceptable if the repaired area is subsequently examined to assure no defect, and it is determined that design thickness requirements are met.

12. Openings in cylinders and connections (valves, fuse plugs, etc.) for those openings. (a) Threads required, to be clean cut, even, without checks, and to gauge.

(b) Taper threads, when used, to be of length not less than as specified for American Standard taper pipe threads.

(c) Straight threads having at least 6 engaged threads are authorized; to have tight fit and calculated shear strength at least 10 times the test pressure of the cylinder; gaskets required, adequate to prevent leakage.

13. Safety devices and protection for valves, safety devices, and other connections, if applied. (a) Must be as required by these regulations that apply (see §§ 73.34(d) and 73.301(g)).

14. Hydrostatic test. (a) By water-jacket, or other suitable method, operated so as to obtain accurate data. Pressure gauge must permit reading to accuracy of 1 per cent. Expansion gauge must permit reading of total expansion to accuracy either of 1 per cent or 0.1 cubic centimetre.

(b) Pressure must be maintained for 30 seconds and sufficiently longer to insure complete expansion. Any internal pressure applied after heat-treatment and previous to the official test must not exceed 90 per cent of the test pressure. If, due to failure of the test apparatus, the test pressure cannot be maintained, the test may be repeated at a pressure increased by 10 per cent or 100 pounds per square inch, whichever is the lower.

(c) Permanent volumetric expansion must not exceed 10 per cent of total volumetric expansion at test pressure.

(d) Each cylinder must be tested to at least 5/3 times service pressure.

15. Flattening test. (a) Between knife edges, wedge shaped, 60° angle, rounded to ½" radius; test 1 cylinder[1] taken at random out of each lot of 200 or less, after hydrostatic test.

16. Physical test. (a) To determine yield strength, tensile strength, elongation, and reduction of area of material. Required on 2 specimens cut from 1[1] cylinder taken at random out of each lot of 200 or less.

(b) Specimens must be: Gauge length 8 inches with width not over 1½ inches; or, gauge length 2 inches with width not over 1½ inches: Provided, That gauge length at least 24 times thickness with width not over 6 times thickness is authorized when cylinder wall is not over 3/16 inch thick. The specimen, exclusive of grip ends, must not be flattened. Grip ends may be flattened to within one inch of each end of the reduced section. When size of cylinder does not permit securing straight specimens, the specimens may be taken in any location or direction and may be straightened or flattened cold, by pressure only, not by blows; when specimens are so taken and prepared, the inspector's report must show in connection with record of physical tests detailed information in regard to such specimens. Heating of specimen for any purpose is not authorized.

(c) The yield strength in tension shall be the stress corresponding to a permanent strain of 0.2 per cent of the gauge length.

(1) The yield strength shall be determined by either the "offset" method or the "extension under load" method as prescribed in ASTM Standard E8-57T.

(2) In using the "extension under load" method, the total strain (or "extension under load") corresponding to the stress at which the 0.2 per cent permanent strain occurs may be determined with sufficient accuracy by calculating the elastic extension of the gauge length under appropriate load and adding thereto 0.2 per cent of the gauge length. Elastic extension calculations shall be based on an elastic modulus of 30,000,000. In the event of controversy, the entire stress-strain diagram shall be plotted and the yield strength determined from the 0.2 per cent offset.

(3) For the purpose of strain measurement, the initial strain shall be set while the specimen is under a stress of 12,000 pounds per square inch, the strain indicator reading being set at the calculated corresponding strain.

(4) Cross-head speed of the testing machine shall not exceed ⅛ inch per minute during yield strength determination.

17. Physical and flattening tests. (a) Acceptable results for physical and flattening tests; elongation at least 20 per cent for 2" gauge length or at least 10 per cent in other cases; flattening required without cracking to 6 times wall thickness.

18. Leakage test. (a) All spun cylinders and plugged cylinders (see Notes 1 and 2) must be tested for leakage by gas or air pressure after the bottom has been cleaned and is free from all moisture. Pressure, approximately the same as but no less than service pressure, must be applied to one side of the finished bottom over an area of at least 1/16 of the total area of the bottom but not less than ¾ inch in diameter, including the closure, for at least one minute, during which time the other side of the bottom exposed to pressure must be covered with water and closely examined for indications of leakage. Leakers must be rejected. (See Note 1 to sec. 19.)

NOTE 1: A spun cylinder is one in which an end closure in the finished cylinder has been welded by the spinning process.

NOTE 2: A plugged cylinder is one in which a permanent closure in the bottom of a finished cylinder has been effected by a plug.

NOTE 3: As a safety precaution, if the manufacturer elects to make this test before the hydrostatic test, he should design his apparatus so that the pressure is applied to the smallest area practicable, around the point of closure, and so as to use the smallest possible volume of air or gas.

19. Rejected cylinders. (a) Reheat treatment authorized; subsequent thereto, acceptable cylinders must pass all prescribed tests. Repair by welding or spinning is not authorized.

NOTE 1: Spun cylinders rejected under the provisions of sec. 18 may be removed from the spun cylinder category by drilling to remove defective material, tapping and plugging.

20. Marking[4]. (a) Marking on each cylinder by stamping plainly and permanently on shoulder, top head, or neck as follows:

(1) When cylinders are constructed to para. 2(a), they shall be marked CTC-3AA followed by the service pressure (for example, CTC-3AA1800 etc.).

[1] For lots of 30 or less, physical and flattening tests are authorized to be made on a ring at least 8 inches long cut from each cylinder and subjected to same heat treatment as the finished cylinder.

[4] Specification cylinders may be marked BTC or CTC; newly manufactured cylinders shall be marked CTC.

(2) When cylinders are constructed to para. 2(b), they shall be marked CTC-3AAX followed by the service pressure (for example, CTC-3AAX1800, etc.).

(3) A serial[2] number and an identifying symbol (letters); location[3] of number to be just below or immediately following the CTC mark; location[3] of symbol to be just below or immediately following the number. The symbol and numbers must be those of purchaser, user, or maker. The symbol must be registered with the Bureau of Explosives through the Canadian Transport Commission; duplications unauthorized.

Examples: CTC-3AA1800 CTC-3AA1800-1234-XY
1234
XY

(4) Inspector's official mark near serial number; date of test (such as 5-50 for May 1950), so placed that dates of subsequent tests can be easily added; and word "SPUN" or "PLUG" near CTC mark when an end closure in the finished cylinder has been welded by the spinning process, or effected by plugging.

21. Size of marks. (a) At least ¼" high if space permits.

22. Inspector's report. (a) Required to be clear, legible, and in the following form:

(Place)

(Date)

Gas Cylinders

Manufactured for .....Company

Location at

Manufactured by.....Company

Location at

Consigned to .....Company

Location at .

Quantity

Size .....inches outside diameter by .....inches long

Marks stamped into the shoulder of the cylinder are:

Specification CTC

Serial numbers .....to .....inclusive.

Inspector's mark

Identifying symbol (registered)

Test date

Tare weights (yes or no)

Other marks (if any)

These cylinders were made by process of

The cylinders were heat treated by the process of

The.....permitted
(neckrings—footrings)

in sec. 9 were attached by process of.....
(welding—brasing)

The material used was identified by the following .....numbers
(heat-purchase order)

The material used was verified as to chemical analysis and record thereof is attached hereto. The heat numbers.. .....
(were—were not)
marked on the material.

All material, such as plates, billets and seamless tubing, was inspected and each cylinder was inspected both before and after closing in the ends; all that was accepted was found free from seams, cracks, laminations, and other defects which might prove injurious to the strength of the cylinder. The processes of manufacture and heat treatment of cylinders were supervised and found to be efficient and satisfactory.

The cylinder walls were measured and the minimum thickness noted.....inch. The outside diameter was determined by a close approximation to be.....inches. The wall stress was calculated to be.....pounds per square inch under an internal pressure of..... pounds per square inch.

Hydrostatic tests, flattening tests, tensile tests of material, and other tests, as prescribed in specification CTC-3AA were made in the presence of the inspector and all material and cylinders accepted were found to be in compliance with the requirements of that specification. Records thereof are attached hereto.

I hereby certify that all of these cylinders proved satisfactory in every way and comply with the requirements of the Commission specification No. 3AA except as follows:

Exceptions ..

(Signed).....
Inspector.

(Place)

(Date)

RECORD OF CHEMICAL ANALYSIS OF MATERIAL FOR CYLINDERS

Numbered.....to.....inclusive.
Size.....inches outside diameter by.....inches long.
Made by .....Company
For .....Company

NOTE: Any omission of analyses by heats, if authorized, must be accounted for by notation hereon reading "The prescribed certificate of the manufacturer of material has been secured, found satisfactory, and placed on file," or by attaching a copy of the certificate.

Test No.	Heat No.	Check analysis No.	Cylinders represented (Serial Nos.)	Chemical analysis								
				C	P	S	Si	Mn	Ni	Cr	Mo	Zr

The analyses were made by

(Signed)

[2] Lot numbers, not over 500 cylinders in each lot, authorized for cylinders not over 2 inches outside diameter and for cylinders over 2 inches outside diameter when the volumetric capacity does not exceed 60 cubic inches.

[3] Symbol in front of or following the number with ample space between is also authorised. Other variation in location authorized only when necessitated by lack of space.

[2] The "service pressure" limits the use of the cylinder. It is shown by marks on cylinder; for example, CTC-3B300 indicates the service pressure as 300 pounds per square inch.

(Place) . . . . . .
(Date) . . . . . .

RECORD OF PHYSICAL TESTS OF MATERIAL FOR CYLINDERS

Numbered ..... to ..... inclusive.
Size ..... inches outside diameter by ..... inches long.
Made by ..... Company.
For ..... Company.

Test No.	Cylinders represented by test (Serial Nos.)	Yield strength at 0.2 per cent offset (lbs. per square inch)	Tensile strength (lbs. per square inch)	Elongation (per cent 8 inches	Reduction of area (per cent)	Flattening test
.....						

(Signed) .....
(Place) .....
(Date) .....

RECORD OF HYDROSTATIC TESTS ON CYLINDERS

Numbered ..... to ..... inclusive.
Size .....inches outside diameter by ..... inches long.
Made by ..... Company.
For ..... Company.

Serial numbers of cylinders tested arranged numerically	Actual test pressure (pounds per square inch)	Total expansion (cubic centimetres)[1]	Permanent expansion (cubic centimetres)[1]	Percent ratio of permanent expansion to total expansion[1]	Tare weight (pounds)[2]	Volumetric capacity

[1] If the tests are made by a method involving the measurement of the amount of liquid forced into the cylinder by the test pressure, then the basic data on which the calculations are made, such as the pump factors, temperature of liquid, coefficient of compressibility of liquid, etc. must also be given.

[2] Do not include removable cap but state whether with or without valve. These weights must be accurate to a tolerance of 1 percent.

(Signed) .....

Specification 3AL

SEAMLESS CYLINDERS MADE OF DEFINITELY PRESCRIBED ALUMINUM ALLOYS

1. Compliance. (a) Required in all details.

2. Type, size and service pressure. (a) Seamless, not over 1000 pounds capacity and at least 150 psig.

3. Inspection by whom and where. (a) By competent and independent inspector approved by the Canadian Transport Commission.

(b) Except as provided in paragraph (c) of this section, for cylinders not made in Canada the tests, as specified, shall be made within the limits of Canada unless written permission is obtained from the Commission to conduct the tests elsewhere.

(c) Cylinders made within the United States of America may be transported by rail in Canada if they have been fabricated and tested in complete accordance with the applicable CTC or DOT Specification under the supervision of a representative from an independent agency approved by the Commission.

4. Duties of the Inspector. (a) The inspector shall determine that all materials comply with this specification before releasing those materials for cylinder manufacture.

(b) The inspector shall verify compliance with the provisions of subparagraph (5)(d)(1) by:

(1) Performing or witnessing the performance of the chemical analyses on each melt or cast lot or other unit of starting material; or

(2) Obtaining a certified check analysis on one cylinder out of each lot of 200 cylinders or less, if a certificate containing data to indicate compliance with the material specification is obtained.

(c) The inspector shall verify ultrasonic inspection of all materials by inspection or by obtaining the material producer's certificate of ultrasonic inspection. Ultrasonic inspection must be performed or verified as having been performed in accordance with paragraph 5(e).

(d) The inspector shall determine that each cylinder complies with this specification by:

(1) Making a complete internal inspection before closing:

(2) Making a complete external inspection;

(3) Verifying that heat treatment was proper;

(4) Selecting the samples for all tests;

(5) Selecting the samples for check analyses performed by other than the material producer;

(6) Witnessing each test;

(7) Verifying that the prescribed minimum thickness was met by measuring or witnessing the measurement of the wall thickness;

(8) Verifying that the identification of material is proper;

(9) Verifying the threads, by gauge;

(10) Reporting volumetric capacity, tare weight, and minimum thickness noted;

(11) Determining that each cylinder is marked in compliance with the specification; and

(12) Rendering complete report required by this specification to cylinder maker, Canadian Transport Commission and upon request to the purchaser.

(e) Prior to initial production of any design or design change, the inspector shall verify that the design qualification tests prescribed in paragraph 6(f) have been performed with acceptable results.

(f) In this specification, a "lot" means a group of cylinders successively produced having the same:

(1) Size and configuration;

(2) Specified material of construction;

(3) Process of manufacture and heat treatment;

(4) Equipment of manufacture and heat treatment; and

(5) Conditions of time, temperature and atmosphere during

heat treatment.

(6) In no case may the lot size exceed 200 cylinders, but any cylinder processed for use in the required destructive physical testing need not be counted as being one of the 200.

5. Authorized material and identification of material. (a) Starting stock must be cast stock or traceable to cast stock.

(b) Material with seams, cracks, laminations, or other defects likely to weaken the finished cylinder may not be used.

(c) Material must be identified by a suitable method that will identify the alloy, the aluminum producer's cast number, the solution heat treat batch number and the lot number.

(d) The material must be of uniform quality. Only the following heat treatable aluminum alloys are permitted:

(1) CHEMICAL COMPOSITION LIMITS[1]

Aluminum Association alloy designation No.	Chemical Composition								Other[2]		
	Si	Fe	Cu	Mn	Mg	Cr	Zn	Ti	Each	Total	Al
6351	0.7 - 1.3	0.50 maximum	0.10 maximum	0.40 - 0.8	0.40 - 0.8	.....	0.20 maximum	0.20 maximum	0.05 maximum	0.15 maximum	Remainder.
6061	0.40 - 0.8	0.7 maximum	0.15 - 0.40	0.15 maximum	0.8 - 1.2	0.04 - 0.35	0.25 maximum	0.15 maximum	0.05 maximum	0.15 maximum	Remainder.

[1] ASTM B 221-76 Standard Specification for Aluminum-Alloy Extruded Bars, Rods Shapes, and Tubes, Table 1 Chemical Composition Limits.

[2] Analysis is regularly made only for the elements for which specific limits are shown, except for unalloyed aluminum. If, however, the presence of other elements is suspected to be, or in the course of routine analysis is indicated to be in excess of specified limits, further analysis is made to determine that these other elements are not in excess of the amount specified.

(2) MECHANICAL PROPERTY LIMITS

Alloy and temper	Tensile strength—PSI		Elongation—percent minimum for 2" or 4D[1] size specimen
	Ultimate—minimum	Yield—minimum	
6351 - T6	42,000	37,000	14[2]
6061 - T6	38,000	35,000	14[2]

[1] "D" represents specimen diameter.

[2] When cylinder wall is not over 5/16-inch thick, 10 percent elongation is authorized when using a 24t × 6t size test specimen.

(e) All starting stock must be 100 percent ultrasonically inspected, along the length at right angles to the central axis from two positions at 90° to one another. The equipment and continuous scanning procedure must be capable of detecting and rejecting internal defects such as cracks which have an ultrasonic response greater than that of a calibration block with a 5/64-inch diameter flat bottomed hole.

(f) Cast stock must have uniform equiaxed grain structure not to exceed 500 micron maximum.

(g) Any starting stock not complying with the above must be rejected.

6. Manufacture. (a) Cylinder shells must be manufactured by the backward extrusion method and have a cleanliness level adequate to ensure proper inspection.

(b) No fissure or other defect is acceptable that is likely to weaken the finished cylinder below the design strength requirements. A reasonably smooth and uniform surface finish is required. If not originally free from such defects, the surface may be machined or otherwise conditioned to eliminate these defects.

(c) The thickness of the cylinder base may not be less than the prescribed minimum wall thickness of the cylindrical shell. The cylinder base must have a basic torispherical, hemispherical, or ellipsoidal interior base configuration where the dish radius is no greater than 1.2 times the inside diameter of the shell. The knuckle radius may not be less than 12 percent of the inside diameter of the shell.

(d) For free standing cylinder, the base thickness must be at least two times the minimum wall thickness along the line of contact between the cylinder base and the floor when the cylinders are in the vertical position.

(e) Welding or brazing is prohibited.

(f) Each new design and any significant change to any acceptable design must be qualified for production by testing prototype samples as follows:

(1) Three samples must be subjected to 100,000 pressure reversal cycles between zero and service pressure or 10,000 pressure reversal cycles between zero and test pressure, at a rate not in excess of 10 cycles per minute without failure.

(2) Three samples must be pressurized to destruction and failure must not occur at less than 2.5 times the marked cylinder service pressure. Each cylinder must remain in one piece. Failure must initiate in the cylinder sidewall in a longitudinal direction. Rate of pressurization must not exceed 200 psi per second.

(g) In this section "significant change" means a 10 percent or greater change in cylinder wall thickness, service pressure, or diameter; a 30 percent or greater change in water capacity or base thickness; any change in material; over 100 percent increase in size of openings; or any change in the number of openings.

7. Wall thickness. (a) The minimum wall thickness must be such that the wall stress at the minimum specified test pressure will not exceed 80 percent of the minimum yield strength nor exceed 67 percent of the minimum ultimate tensile strength as verified by physical tests in paragraph 13.

(b) Calculations must be made by the formula:

$S = P(1.3\ D^2 + 0.4d^2) / (D^2 - d^2)$

Where:

S = Wall stress in pounds per square inch

P = Prescribed minimum test pressure in pounds per square inch

D = Outside diameter in inches; and

d = Inside diameter in inches.

(c) The minimum wall thickness for any cylinder with an outside diameter greater than 5 inches must be 0.125 inch.

8. Openings. (a) Openings are permitted in heads only.

(b) The size of any centered opening in a head may not exceed one-half the outside diameter of the cylinder.

(c) Other openings are permitted in the head of a cylinder if:

(1) Each opening does not exceed 2.625 inches in diameter, or one-half the outside diameter of the cylinder; whichever is less;

(2) Each opening is separated from each other by a ligament; and

(3) Each ligament which separates two openings must be at least three times the average of the diameters of the two openings.

(d) All openings must be circular.

(e) All openings must be threaded. Threads must comply with the following:

(1) Each thread must be clean cut, even, without any checks, and to gauge.

(2) Taper threads, when used, must be the American Standard Pipe Thread (NPT) type complying with the USDC, NBS Handbook H-28, Part III, Section VII, or the National Gas Taper Thread (NGT) standard complying with NBS Handbook H-28, Part II Sections VII and IX.

(3)Straight threads conforming with National Gas Straight Thread (NGS) standards are authorized. These threads must comply with NBS Handbook H-28, Part II, Sections VII and IX.

9. Heat treatment. (a) Prior to any test, all cylinders must be subjected to a solution heat treatment and aging treatment appropriate for the aluminum alloy used.

10. Pressure relief devices and protection for valves, pressure relief devices, and other connections. (a) Pressure relief devices and protection arrangements for valves, pressure relief devices, and other connections must comply with §§ 73.34(d) and 73.301(g) of these regulations.

11. Hydrostatic test. (a) Each cylinder must be subjected to an internal test pressure using the water jacket equipment and method or other suitable equipment and method. The testing apparatus must be operated in a manner so as to obtain accurate data. The pressure gauge used must permit reading to an accuracy of one percent. The expansion gauge must permit reading the total expansion to an accuracy of either one percent or 0.1 cubic centimeter.

(b) The test pressure must be maintained for a sufficient period of time to assure complete expansion of the cylinder. In no case may the pressure be held less than 30 seconds. If, due to failure of the test apparatus, the required test pressure cannot be maintained, the test may be repeated at a pressure increased by 10 percent or 100 psi, whichever is lower. If the test apparatus again fails to maintain the test pressure, the cylinder being tested must be rejected. Any internal pressure applied to the cylinder before any official test may not exceed 90 percent of the test pressure.

(c) The minimum test pressure is the greatest of the following:

(1) 450 psi regardless of service pressure;

(2) Two times the service pressure for cylinders having service pressure less than 500 psi; or

(3) Five-thirds times the service pressure of cylinders having a service pressure of at least 500 psi.

(d) Permanent volumetric expansion may not exceed 10 percent of total volumetric expansion at test pressure.

12. Flattening test. (a) The flattening test must be performed on one cylinder taken at random out of each lot of 200 or less by placing the cylinder between wedge shaped knife edges having a 60° included angle, and rounded in accordance with the following table. The longitudinal axis of the cylinder must be at an angle 90° to the knife edges during the test.

TABLE

Cylinder wall thickness in inches	Radius in inches
Under .150	.500
.150 to .249	.875
.250 to .349	1.500
.350 to .449	2.125
.450 to .549	2.750
.550 to .649	3.500
.650 to .749	4.125

(b) An alternate bend test in accordance with ASTM E 290-77 using a mandrel diameter not more than 6 times the wall thickness is authorized to qualify lots that fail the flattening test of this section without reheat treatment. If used, this test must be performed on two samples from one cylinder taken at random out of each lot of 200 cylinders or less.

(c) Each test cylinder must withstand flattening to nine times the wall thickness without cracking. When the alternate bend test is used, the test specimens shall remain uncracked when bent inward around a mandrel in the direction of curvature of the cylinder wall until the interior edges are at a distance apart not greater than the diameter of the mandrel.

13. Mechanical properties test. (a) Two test specimens cut from one cylinder representing each lot of 200 cylinders or less must be tested. The results of the test must conform to at least the minimum acceptable mechanical property limits for aluminum alloys as specified in subparagraph 5(d)(2).

(b) Specimens must be 4D bar or gauge length 2 inches with width not over 1½ inch taken in the direction of extrusion approximately 180° from each other; provided

that gauge length at least 24 times thickness with width not over 6 times thickness is authorized, when cylinder wall is not over 3/16 inch thick. The specimen, exclusive of grip ends may not be flattened. Grip ends may be flattened to within one inch of each end of the reduced section. When the size of the cylinder does not permit securing straight specimens, the specimens may be taken in any location or direction and may be straightened or flattened cold by pressure only, not by blows. When such specimens are used, the inspector's report must show that the specimens were so taken and prepared. Heating of specimens for any purpose is forbidden.

(c) The yield strength in tension must be the stress corresponding to a permanent strain of 0.2 percent of the gauge length.

(1) The yield strength must be determined by either the "offset" method or the "extension under load" method as prescribed in ASTM Standard B-557-79.

(2) In using the "extension under load" method, the total strain (or "extension under load") corresponding to the stress at which the 0.2 percent permanent strain occurs may be determined with sufficient accuracy by calculating the elastic extension of the gauge length under appropriate load and adding thereto 0.2 percent of the gauge length. Elastic extension calculations must be based on an elastic modulus of 10,000,000 psi. In the event of controversy, the entire stress-strain diagram must be plotted and the yield strength determined from the 0.2 percent offset.

(3) For the purpose of strain measurement, the initial strain must be set while the specimen is under a stress of 6,000 psi, the strain indicator reading being set at the calculated corresponding strain.

(4) Cross-head speed of the testing machine may not exceed 1/8 inch per minute during yield strength determination.

14. Rejected cylinder. Reheat treatment of rejected cylinders is authorized one time; subsequent thereto, cylinders must pass all prescribed tests to be acceptable.

15. Marking. (a) Each cylinder must be plainly and permanently marked, by stamping on the cylinder shoulder, top head, or neck, in the following order:

(1) The specification marking "CTC-3AL" must appear first on the cylinder followed immediately by the service pressure (for example: CTC-3AL 1800).

(2) The serial number and an identifying symbol or letters appear next; location of the number to be just below or immediately following the mark; location of the symbol to be just below or immediately following the number. The symbol and numbers must be those of the maker.

Examples:

CTC-3AL 1800
1234
XY
or: CTC-3AL 1800-1234-XY.

(3) Inspector's official mark, near serial number, date of test (such as 5-81 for May 1981), so placed that dates of subsequent tests can be easily added.

(4) Marks must be at least 1/4 inch high if space permits.

(b) Other marks are authorized provided they are made in low stress areas other than the side wall and are not of a size and depth that will create harmfull stress concentrations. Such marks may not conflict with any CTC required markings.

16. Inspector's report. Required to be clear, legible, and in the following form:

(Place) . . . .
(Date) . . . .
Gas Cylinders'
Manufactured for . . . . . Company
Location at . . . .
Manufactured by . . . . . Company
Location at . . . .
Consigned to . . . . . .
Location at . . . .
Quantity . . . . . .
Size . . . . . inches outside diameter by . . . . . inches long
Marks stamped into the shoulder of the cylinder are:
Specification CTC . . . . . .
Serial numbers . . . . . to . . . . . inclusive
Cylinder manufacturer's identification symbol . . . . . .
Inspector's mark . . . . . .
Test date . . . . . .
Tare weights (yes or no)
Other marks (if any) . . . . . .
These cylinders were made by process of . . . . . .
The cylinders were heat treated by the process of . . . . . .
(alloy and temper designation).

The material used was verified as to chemical analysis and record thereof is attached hereto.

All material and each cylinder were inspected: all that were accepted were found free from seams, cracks, lamination, and other defects which might prove injurious to the strength of the cylinder. The processes of manufacture and heat treatment of cylinders were supervised and found to be efficient and satisfactory.

The cylinder walls were measured and the minimum thickness noted was at least equal to the minimum design thickness. The outside diameter was determined to be . . . . . inches. The wall stress was calculated to be . . . . . pounds per square inch under an internal pressure of . . . . . pounds per square inch. The required minimum thickness is . . . . . inch.

Hydrostatic tests, flattening tests, tensile tests of material, and other tests, as prescribed in Specification CTC-3AL were made in the presence of the inspector and all material and cylinders accepted were found to be in compliance with that specification. Records thereof are attached hereto.

I hereby certify that all of these cylinders proved satisfactory in every way and comply with the requirements of the Commission specification No. 3AL except as follows:

Exceptions . . . . . (Signed) . . . . . (Inspector)
. . . . . .
. . . . . (Place) . . . . .
. . . . . (Date) . . . . .

RECORD OF CHEMICAL ANALYSES OF MATERIAL FOR CYLINDERS

Numbered . . . . . to . . . . . inclusive.
Size . . . . . inches outside diameter by . . . . . inches long.
Made by . . . . . Company.
For . . . . . Company.

NOTE: Any omission of analyses by heats, if authorized, must be accounted for by notation hereon reading "The prescribed certificate of the manufacturer of material has been secured, found satisfactory, and placed on file," or by attaching a copy of the certificate.

Alloy designation*	Cylinders represented (serial Nos.)	Chemical analyses									
		Si	Fe	Cu	Mn	Mg	Cr	Zn	Ti	Others Ea. Total	Al

*Aluminum Association Alloy Designation Number.

The analyses were made by

(Signed) . . . . .
(Place) . . . . .
(Date) . . . . .

RECORD OF PHYSICAL TESTS OF MATERIAL FOR CYLINDERS

Numbered ..... to ..... inclusive.
Size ..... inches outside diameter by ..... inches long.
Made by ..... Company.
For ..... Company.

Test No.	Cylinders represented by test (Serial Nos.)	Yield strength at 0.2 per cent offset (lbs. per sq. inch)	Tensile strength (lbs. per sq. inch)	Elongation (percent in ____ size specimen)	Flattening test (record as multiple of t)

(Signed) .....
(Place) .....
(Date) .....

RECORD OF HYDROSTATIC TESTS ON CYLINDERS

Numbered ..... to ..... inclusive.
Size .....inches outside diameter by ..... inches long.
Made by ..... Company.

Serial numbers of cylinders tested arranged numerically	Actual test pressure (lbs. per sq. inch)	Total expansion (cubic centimetres)[1]	Permanent expansion (cubic centimetres)[1]	Percent ratio of permanent expansion to total expansion[1] (Actual value)	Tare weight (lbs.)[2]	Volumetric capacity

[1] If the tests are made by a method involving the measurement of the amount of liquid forced into the cylinder by the test pressures, then the basic data on which the calculations are made, such as the pump factors, temperature of liquid, coefficient of compressibility of liquids, etc. must also be given.

[2] Do not include removable cap but state whether with or without valve. These weights must be accurate to a tolerance of 1 percent.

(Signed) .....
(Place) .....
(Date) .....

Specification 3B

SEAMLESS STEEL CYLINDERS

1. Compliance. (a) Required in all details.

2. Type, size, and service pressure. (a) Type and size. Seamless; not over 1,000 pounds water capacity (nominal).

(b) Service pressure. At least 150 to not over 500 pounds per square inch.

3. Inspection by whom and where. (a) By competent and independent inspector approved by the Canadian Transport Commission.

(b) Except as provided in paragraph (c) of this section, for cylinders not made in Canada the tests, as specified, shall be made within the limits of Canada unless written permission is obtained from the Commission to conduct the tests elsewhere.

(c) Notwithstanding paragraph (b) of this section cylinders made within the United States of America shall not be transported by rail in Canada unless they have been fabricated and tested in complete accordance with the applicable CTC or DOT Specification under the supervision of a representative from an independent inspection agency approved by the Commission.

4. Duties of inspector. (a) Inspect all material and reject any not complying with requirements; for cylinders made by billet-piercing process, billets to be inspected after nick and cold break.

(b) Verify chemical analysis of each heat of material by analysis or by obtaining certified analysis: Provided, that a certificate from the manufacturer thereof, giving sufficient data to indicate compliance with requirements, is acceptable when verified by check analyses of samples taken from one cylinder out of each lot of 200 or less.

(c) Verify compliance of cylinders with all requirements including markings; inspect inside before closing in both ends; verify heat treatment as proper; obtain samples for all tests and check chemical analyses; witness all tests; verify threads by gauge; report volumetric capacity and tare weight (see report form) and minimum thickness of wall noted.

(d) Render complete report required by this specification to cylinder maker. Canadian Transport Commission and upon request to the purchaser.

5. Steel. (a) Open-hearth or electric steel of uniform quality. Content per cent for the following not over: Carbon, 0.55; phosphorus, 0.045 sulphur, 0.050.

6. Identification of material. (a) Required; any suitable method except that plates and billets for hot-drawn cylinders shall be marked with heat number.

7. Defects. (a) Material with seams, cracks, laminations, or other injurious defects, not authorized.

8. Manufacture. (a) By best appliances and methods; dirt and scale to be removed as necessary to afford proper inspection; no fissure or other defect acceptable that is likely to weaken the finished cylinder appreciably; reasonably smooth and uniform surface finish required. If not originally free from such defects, the surface may be machined or otherwise treated to eliminate these defects. The thickness of the bottoms of cylinders welded or formed by spinning is, under no conditon, to be less than two times the minimum wall thickness of the cylindrical shell; such bottom thicknesses to be measured within an area bounded by a line representing the points of contact between the cylinder and floor when the cylinder is in a vertical position.

9. Welding or brazing. (a) Welding or brazing for any purpose whatsoever is prohibited except as follows:

(1) Welding or brazing is authorized for the attachment of neckrings and footrings which are non-pressure parts, and only to the tops and bottoms of cylinders having a service pressure of 500 pounds per square inch or less. Cylinders, neckrings, and footrings must be made of weldable steel, carbon content of which must not exceed 0.25 per cent except in the case of 4130X steel which may be used with proper welding procedure.

(2) As permitted in sec. 8.

10. Wall thickness.(a) The wall stress shall not exceed 24,000 pounds per square inch. Minimum wall 0.090″ for any cylinder over 6″ outside diameter.

(b) Calculation must be made by the formula:

$$S = \frac{P\,(1.3D^2 + 0.4d^2)}{D^2 - d^2}$$

where:

S = wall stress in pounds per square inch;
P = minimum test pressure prescribed for water-jacket test or 450 pounds per square inch whichever is the greater;
D = outside diameter in inches;
d = inside diameter in inches;

11. Heat treatment. (a) The completed cylinders must be uniformly and properly heat-treated prior to tests.

12. Openings in cylinders and connections (valves, fuse plugs, etc.) for those openings. (a) Threads required, to be clean cut, even, without checks, and to gauge.

(b) Taper threads, when used, to be of length not less than as specified for American Standard taper pipe threads.

(c) Straight threads having at least 4 engaged threads are authorized; to have tight fit and calculated shear strength at least 10 times the test pressure of the cylinder; gaskets required, adequate to prevent leakage.

13. Safety devices and protection for valves, safety devices, and other connections, if applied. (a) Must be as required by Canadian Transport Commission regulations that apply (see §§ 73.34(d) and 73.301(g).

14. Hydrostatic test. (a) By water-jacket, or other suitable method, operated so as to obtain accurate data. Pressure gauge must permit reading to accuracy of 1 per cent. Expansion gauge must permit reading of total expansion to accuracy either of 1 per cent or 0.1 cubic centimetre.

(b) Pressure must be maintained for 30 seconds and sufficiently longer to insure complete expansion. Any internal pressure applied after heat treatment and previous to the official test must not exceed 90 per cent of the test pressure. If, due to failure of the test apparatus, the test pressure cannot be maintained, the test may be repeated at a pressure increased by 10 per cent or 100 pounds per square inch, whichever is the lower.

(c) Permanent volumetric expansion must not exceed 10 per cent of total volumetric expansion at test pressure.

(d) Cylinders must be tested as follows:

(1) Each cylinder; to at least 2 times service pressure.

(2) Or, 1 cylinder out of each lot of 200 or less; to at least 3 times service pressure. Others must be examined under pressure of 2 times service pressure and show no defect.

15. Flattening test. (a) Between knife edges, wedge shaped, 60° angle, rounded to ½" radius; test 1 cylinder[1] taken at random out of each lot of 200 or less, after hydrostatic test.

16. Physical test. (a) To determine yield strength, tensile strength, elongation, and reduction of area of material. Required on 2 specimens cut from 1[1] cylinder taken at random out of each lot of 200 or less.

(b) Specimens must be: Gauge length 8 inches with width not over 1½ inches, or, gauge length 2 inches with width not over 1½ inches: Provided, That gauge length at least 24 times thickness with width not over 6 times thickness is authorized when cylinder wall is not over 3/16 inch thick. The specimen, exclusive of grip ends, must not be flattened. Grip ends may be flattened to within one inch of each end of the reduced section. When size of cylinder does not permit securing straight specimens, the specimens may be taken in any location or direction and may be straightened or flattened cold, by pressure only, not by blows; when specimens are so taken and prepared, the inspector's report must show in connection with record of physical tests detailed information in regard to such specimens. Heating of specimen for any purpose is not authorized.

(c) The yield strength in tension shall be the stress corresponding to a permanent strain of 0.2 per cent of the gauge length.

(1) The yield strength shall be determined by either the "offset" method or the "extension under load" method as prescribed in ASTM Standard E8-57T.

(2) In using the "extension under load" method, the total strain (or "extension under load") corresponding to the stress at which the 0.2 per cent permanent strain occurs may be determined with sufficient accuracy by calculating the elastic extension of the gauge length under appropriate load and adding thereto 0.2 per cent of the gauge length. Elastic extension calculations shall be based on an elastic modulus of 30,000,000. In the event of controversy, the entire stress-strain diagram shall be plotted and the yield strength determined from the 0.2 per cent offset.

(3) For the purpose of strain measurement, the initial strain shall be set while the specimen is under a stress of 12.000 pounds per square inch, the strain indicator reading being set at the calculated corresponding strain.

(4) Cross-head speed of the testing machine shall not exceed ⅛ inch per minute during yield strength determination.

17. Acceptable results for physical and flattening tests. (a) Either of the following:

(1) Elongation at least 40 per cent for 2-inch gauge length or at least 20 per cent in other cases; yield strength not over 73 per cent of tensile strength; flattening test not required.

(2) Elongation at least 20 per cent for 2-inch gauge length or 10 per cent in other cases; yield strength not over 73 per cent of tensile strength; flattening required, without cracking, to 6 times wall thickness.

18. Leakage test. (a) All spun cylinders and plugged cylinders (see Notes 1 and 2) must be tested for leakage by gas or air pressure after the bottom has been cleaned and is free from all moisture. Pressure, approximately the same as but no less than service pressure, must be applied to one side of the finished bottom over an area of at least 1/16 of the total area of the bottom but not less than ¾ inch in diameter, including the closure, for at least one minute, during which time the other side of the bottom exposed to

[1] For lots of 30 or less physical and flattening tests are authorized to be made on a ring at least 8 inches long cut from each cylinder and subjected to same heat treatment as the finished cylinder.

pressure must be covered with water and closely examined for indications of leakage. Leakers must be rejected. (See Note 1 to sec. 19.)

NOTE 1: A spun cylinder is one in which an end closure in the finished cylinder has been welded by the spinning process.

NOTE 2: A plugged cylinder is one in which a permanent closure in the bottom of a finished cylinder has been effected by a plug.

NOTE 3: As a safety precaution, if the manufacturer elects to make this test before the hydrostatic test, he should design his apparatus so that the pressure is applied to the smallest area practicable, around the point of closure, and so as to use the smallest possible volume of air or gas.

19. Rejected cylinders. (a) Reheat treatment authorized; subsequent thereto, acceptable cylinders must pass all prescribed tests. Repair by welding or spinning is not authorized.

NOTE 1: Spun cylinders rejected under the provisions of sec. 18 may be removed from the spun cylinder category by drilling to remove defective material, tapping and plugging.

20. Marking. (a) Marking on each cylinder by stamping plainly and permanently on shoulder, top head, or neck as follows:

(1) CTC-3B followed by the service pressure (for example CTC-3B300, etc.).

(2) A serial[2] number and an identifying symbol (letters); location[3] of number to be just below or immediately following the CTC mark; location[3] of symbol to be just below or immediately following the number. The symbol and numbers must be those of purchaser, user, or maker. The symbol must be registered with the Bureau of Explosives through the Canadian Transport Commission; duplications unauthorized.

Examples:	CTC-3B300 1234 XY	CTC-3B300-1234-XY

(3) Inspector's official mark near serial number; date of tests (such as 5-50 for May 1950), so placed that dates of subsequent tests can be easily added; and word "SPUN" or "PLUG" near CTC mark when an end closure in the finished cylinder has been welded by the spinning process, or, effected by plugging.

(b) Marking stamped into the sidewalls of cylinder having a service pressure of 150 psi. is permitted only if all of the following conditions are met

(1) Wall stress at test pressure shall not exceed 24,000 psi.

(2) Minimum wall thickness shall be not less than .090″.

(3) Depth of stamping shall be no greater than 15% of the minimum wall thickness, but at no time shall it exceed .015″.

(4) Maximum outside diameter of cylinder shall not exceed 5″.

(5) Carbon content of cylinder shall not exceed 0.25%. If the carbon content exceeds 0.25%, the complete cylinder must be normalized after stamping.

(6) Stamping shall be adjacent to top head.

21. Size of marks. (a) At least ¼″ high if space permits.

22. Inspector's report. (a) Required to be clear, legible, and in following form:

(Place)
(Date)

Gas Cylinders
Manufactured for .....Company

Location at .....

Manufactured by Company

Location at

Consigned to .....Company

Location at .....

Quantity.....

Size.....inches outside diameter by.....inches long.

Marks stamped into the shoulder of the cylinder are:

Specification CTC

Serial numbers.....to.....inclusive.

Inspector's mark

Identifying symbol (registered) .....

Test date

Tare weights (yes or no).....

Other marks (if any) .....

These cylinders were made by process of.....

The .....permitted
(neckrings—footrings)
in sec. 9 were attached by process of.....

(welding—brazing)

The material used was identified by the following ..... numbers
(heat-purchase order)

The material used was verified as to chemical analysis and record thereof is attached hereto. The heat numbers
(were—were not)
marked on the material.

All material, such as plates, billets and seamless tubing, was inspected and each cylinder was inspected both before and after closing in the ends; all that was accepted was found free from seams, cracks, laminations, and other defects which might prove injurious to the strength of the cylinder. The processes of manufacture and heat treatment of cylinders were supervised and found to be efficient and satisfactory.

The cylinder walls were measured and the minimum thickness noted was.....inch. The outside diameter was determined by a close approximation to be.....inches. The wall stress was calculated to be.....pounds per square inch under an internal pressure of.....pounds per square inch.

Hydrostatic tests, flattening tests, tensile tests of material and other tests, as prescribed in specification CTC-3B were made in the presence of the inspector and all material and cylinders accepted were found to be in compliance with the requirements of that specification. Records thereof are attached hereto.

I hereby certify that all of these cylinders proved satisfactory in every way and comply with the requirements of the Canadian Transport Commission specification No. 3B except as follows:

Exceptions .....

(Signed) .....
Inspector.

(Place).....
(Date) .....

RECORD OF CHEMICAL ANALYSIS OF MATERIAL FOR CYLINDERS

Numbered to inclusive.
Size.....inches outside diameter by.....inches long.
Made by .....Company
For .....Company

NOTE: Any omission of analyses by heats, if authorized, must be accounted for by notation hereon reading "The prescribed certificate of the

[2] Lot numbers, not over 500 cylinders in each lot, authorized for cylinders not over 2 inches outside diameter and for cylinders over 2 inches outside diameter when the volumetric capacity does not exceed 170 cubic inches.

[3] Symbol in front of or following the number with ample space between is also authorized. Other variation in location authorized only when necessitated by lack of space.

manufacturer of material has been secured, found satisfactory, and placed on file," or by attaching a copy of the certificate.

Test No.	Heat No.	Check analysis No.	Cylinders represented (Serial Nos.)	Chemical analysis						
				C	P	S	Si	Mn	Ni	Cr

The analyses were made by

(Signed)

(Place) .....

(Date) .....

RECORD OF PHYSICAL TESTS OF MATERIAL FOR CYLINDERS

Numbered ..... to ..... inclusive.
Size ..... inches outside diameter by ..... inches long.
Made by ..... Company
For ..... Company

Test No.	Cylinders represented by test (Serial Nos.)	Yield strength (pounds per square inch)	Tensile strength (pounds per square inch)	Elongation (per cent in 8 inches)	Reduction of area (per cent)	Flattening test

(Signed) .....

(Place) .....
(Date) .....

RECORD OF HYDROSTATIC TESTS ON CYLINDERS

Numbered ..... to ..... inclusive.
Size ..... inches outside diameter by ..... inches long.
Made by ..... Company
For ..... Company

Serial numbers of cylinders tested arranged numerically	Actual test pressure (pounds per square inch)	Total expansion (cubic centimetres)[1]	Permanent expansion (cubic centimetres)[1]	Per cent ratio of permanent expansion to total expansion[1]	Tare weight (pounds)[2]	Volumetric capacity[3]

NOTE: When specifications require test for only 1 out of each lot of 200 or less cylinders, the check on the others must be indicated by a notation hereon reading "Each cylinder was subjected to a pressure of ..... pounds per square inch and showed no defect".

[1] If the tests are made by a method involving the measurement of the amount of liquid forced into the cylinder by the test pressure, then the basic data, on which the calculations are made, such as the pump factors, temperature of liquid, coefficient of compressibility of liquid, etc., must also be given.

[2] Do not include removable cap but state whether with or without valve. These weights must be accurate to a tolerance of 1 per cent.

[3] Report approximate maximum and minimum volumetric capacity for the lot

(Signed) .....

Specification 3BN

SEAMLESS NICKEL CYLINDERS

1. Compliance. (a) Required in all details.

2. Type, size and service pressure. (a) Type and size. Seamless; not over 125 pounds water capacity (nominal).

(b) Service Pressure.[4] At least 150 to not over 500 pounds per square inch.

3. Inspection by whom and where. (a) By competent and independent inspector approved by the Canadian Transport Commission.

(b) Except as provided in paragraph (c) of this section, for cylinders not made in Canada the tests, as specified, shall be made within the limits of Canada unless written permission is obtained from the Commission to conduct the tests elsewhere.

(c) Notwithstanding paragraph (b) of this section cylinders made within the United States of America shall not be transported by rail in Canada unless they have been fabricated and tested in complete accordance with the applicable CTC or DOT Specification under the supervision of a representative from an independent inspection agency approved by the Commission.

4. Duties of inspector. (a) Inspect all material and reject any not complying with requirements.

(b) Verify chemical analysis of each heat of material by analysis or by obtaining certified analysis: Provided, That a certificate from the manufacturer thereof, giving sufficient data to indicate compliance with requirements, is acceptable when verified by check analyses of samples taken from one cylinder out of each lot of 200 or less.

(c) Verify compliance of cylinders with all requirements including markings; inspect inside before closing in both ends; verify heat treatment as proper; obtain samples for all tests and check chemical analyses; witness all tests, verify threads by gauge; report volumetric capacity and tare weight (see report form) and minimum thickness of wall noted.

(d) Render complete report required by this specification to cylinder maker, Canadian Transport Commission and upon request to the purchaser.

5. Nickel. (a) At least 99.0 per cent pure nickel plus cobalt.

6. Identification of material. (a) Required; any suitable method except that plates and billets for hot-drawn cylinders shall be marked with heat number.

7. Defects. (a) Material with seams, cracks, laminations, or other injurious defects, not authorized.

8. Manufacture. (a) By best appliances and methods; dirt and scale to be removed as necessary to afford proper inspection; no defect acceptable that is likely to weaken the finished cylinder appreciably; reasonably smooth and uni-

[4] The "service pressure" limits the use of the cylinder. It is shown by marks on cylinder, for example, CTC-3BN400 indicates the service pressure as 400 pounds per square inch.

form surface finish required. Cylinders closed in by spinning process not authorized.

9. Welding or brazing. (a) Welding or brazing for any purpose whatsoever is prohibited except that welding is authorized for the attachment of neckrings and footrings which are nonpressure parts, and only to the tops and bottoms of cylinders. Neckrings and footrings must be of weldable material, carbon content of which must not exceed 0.25 per cent. Nickel welding rod must be used.

10. Wall thickness. (a) The wall stress shall not exceed 15,000 pounds per square inch. Minimum wall 0.100″ for any cylinder over 5″ outside diameter.

(b) Calculation must be made by the formula:

$$S = \frac{P\,(1.3D^2 + 0.4d^2)}{D^2 - d^2}$$

where:

S = wall stress in pounds per square inch;
P = minimum test pressure prescribed for water-jacket test or 450 pounds per square inch whichever is the greater;
D = outside diameter, in inches;
d = inside diameter in inches.

11. Heat treatment. (a) The completed cylinders must be uniformly and properly heat-treated prior to tests.

12. Openings in cylinders and connections (valves, fuse plugs, etc.) for those openings. (a) Threads required, to be clean cut, even, without checks, and to gauge.

(b) Taper threads, when used, to be of length not less than as specified for American Standard taper pipe threads.

(c) Straight threads having at least 6 engaged threads are authorized; to have tight fit and calculated shear strength at least 10 times the test pressure of the cylinder; gaskets required, adequate to prevent leakage.

13. Safety devices and protection for valves, safety devices, and other connections, if applied. (a) Must be as required by the Canadian Transport Commission regulations that apply (see §§ 73.34 (d) and 73.301 (g)).

14. Hydrostatic test. (a) By water-jacket, or other suitable method, operated so as to obtain accurate data. Pressure gauge must permit reading to accuracy of 1 per cent. Expansion gauge must permit reading of total expansion to accuracy either of 1 per cent or 0.1 cubic centimetre.

(b) Pressure must be maintained for 30 seconds and sufficiently longer to insure complete expansion. Any internal pressure applied after heat-treatment and previous to the official test must not exceed 90 per cent of the test pressure. If, due to failure of the test apparatus, the test pressure cannot be maintained, the test may be repeated at a pressure increased by 10 per cent or 100 pounds per square inch, whichever is the lower.

(c) Permanent volumetric expansion must not exceed 10 per cent of total volumetric expansion at test pressure.

(d) Each cylinder must be tested to at least 2 times services pressure.

15. Flattening test. (a) Between knife edges, wedge shaped, 60° angle, rounded to ½″ radius; test 1 cylinder[1] taken at random out of each lot of 200 or less, after hydrostatic test.

16. Physical test. (a) To determine yield strength, tensile strength, elongation, and reduction of area of material: Required on 2 specimens cut from 1[1] cylinder taken at random out of each lot of 200 or less.

(b) Specimens must be: Gauge length 8 inches with width not over 1½ inches; or, gauge length 2 inches with width not over 1½ inches: Provided, that gauge length at least 24 times thickness with width not over 6 times thickness is authorized when cylinder wall is not over 3/16 inch thick. The specimen, exclusive of grip ends, must not be flattened. Grip ends may be flattened to within one inch of each end of the reduced section. When size of cylinder does not permit securing straight specimens, the specimens may be taken in any location or direction and may be straightened or flattened cold, by pressure only, not by blows; when specimens are so taken and prepared, the inspector's report must show in connection with record of physical tests detailed information in regard to such specimens. Heating of specimen for any purpose is not authorized.

(c) The yield strength in tension shall be the stress corresponding to a permanent strain of 0.2 per cent of the gauge length.

(1) The yield strength shall be determined by either the "offset" method or the "extension under load" method as prescribed in ASTM Standard E8-57T.

(2) In using the "extension under load" method, the total strain (or "extension under load") corresponding to the stress at which the 0.2 per cent permanent strain occurs may be determined with sufficient accuracy by calculating the elastic extension of the gauge length under appropriate load and adding thereto 0.2 per cent of the gauge length. Elastic extension calculations shall be based on an elastic modulus of 30,000,000. In the event of controversy, the entire stress-strain diagram shall be plotted and the yield strength determined from the 0.2 per cent offset.

(3) For the purpose of strain measurement, the initial strain shall be set while the specimen is under a stress of 12,000 pounds per square inch, the strain indicator reading being set at the calculated corresponding strain.

(4) Cross-head speed of the testing machine shall not exceed ⅛ inch per minute during yield strength determination.

17. Acceptable results for physical and flattening tests. (a) Either of the following:

(1) Elongation at least 40 per cent for 2″ gauge length or at least 20 per cent in other casees; yield point not over 50 per cent of tensile strength; flattening test not required.

(2) Elongation at least 20 per cent for 2″ gauge length or 10 per cent in other cases; yield point not over 50 per cent of tensile strength; flattening required, without cracking, to 6 times wall thickness.

18. Rejected cylinders. (a) Reheat treatment authorized; subsequent thereto, acceptable cylinders must pass all prescribed tests. Repair by welding not authorized.

[1] For lots of 30 or less physical and flattening tests are authorized to be made on a ring at least 8 inches long cut from each cylinder and subjected to same heat treatment as the finished cylinder.

19. Marking. (a) Marking on each cylinder by stamping plainly and permanently on shoulder, top head, or neck as follows:

(1) CTC-3BN followed by service pressure (for example, CTC-3BN400, etc.).

(2) A serial[2] number and an identifying symbol (letters); location[3] of number to be just below or immediately following the CTC mark; location[3] of symbol to be just below or immediately following the number. The symbol and numbers must be those of purchaser, user, or maker. The symbol must be registered with the Bureau of Explosives through the Canadian Transport Commission, duplications unauthorized.

Examples: CTC-3BN400 CTC-3BN400-1234-XY
1234
XY

(3) Inspector's official mark, near serial number; date of test (such as 5-50 for May 1950), so placed that dates of subsequent tests can be easily added.

20. Size of marks. (a) At least ¼" high if space permits.

21. Inspector's report. (a) Required to be clear, legible, and in following form:

(Place)
(Date)

Gas Cylinders
Manufactured for ..... Company
Location at .....
Manufactured by ..... Company
Location at .....
Consigned to ..... Company
Location at .....
Quantity .....
Size ..... inches outside diameter by ..... inches long.
Marks stamped into the shoulder of the cylinder are:
Specification CTC .....
Serial numbers ..... to ..... inclusive.
Inspector's mark .....
Identifying symbol (registered)
Test date .....
Tare weights (yes or no)
Other marks (if any) .....
These cylinders were made by process of .....

The (neckrings—footrings) permitted in sec. 9 were attached by process of .....
(welding—brazing)
The material used was identified by the following ..... numbers
(heat-purchase order)

The material used was verified as to chemical analysis and record thereof is attached hereto. The heat numbers .....
(were—were not)
marked on the material.

All material, such as plates billets and seamless tubing, was inspected and each cylinder was inspected both before and after closing in the ends; all that was accepted was found free from seams, cracks, laminations, and other defects which might prove injurious to the strength of the cylinder. The processes of manufacture and heat treatment of cylinders were supervised and found to be efficient and satisfactory.

The cylinder walls were measured and the minimum thickness noted was ..... inch. The outside diameter was determined by a close approximation to be ..... inches. The wall stress was calculated to be .. pounds per square inch under an internal pressure of ..... pounds per square inch.

Hydrostatic tests, flattening tests, tensile tests of material, and other tests, as prescribed in specification CTC-3BN were made in the presence of the inspector and all material and cylinders accepted were found to be in compliance with the requirements of that specification. Records thereof are attached hereto.

I hereby certify that all of these cylinders proved satisfactory in every way and comply with the requirements of the Canadian Transport Commission specification No. 3BN except as follows:
Exceptions .....

(Signed)
Inspector.

(Place)

(Date)

RECORD OF CHEMICAL ANALYSIS OF MATERIAL FOR CYLINDERS

Numbered ..... to ..... inclusive.

Size ..... inches outside diameter by ..... inches long.

Made by ..... Company

For ..... Company

NOTE: Any omission of analyses by heats, if authorized, must be accounted for by notation hereon reading "The prescribed certificate of the manufacturer of material has been secured, found satisfactory, and placed on file," or by attaching a copy of the certificate.

Test No.	Heat No.	Check analysis No.	Cylinders represented (serial Nos.)	Chemical analysis						
				C	P	S	Si	Mn	Ni	Cr

The analyses were made by .....

(Signed) ...

(Place)

(Date) .....

RECORD OF PHYSICAL TESTS OF MATERIAL FOR CYLINDERS

Numbered to inclusive

Size ..... inches outside diameter by ..... Inches long.

Made by Company

For Company

Test No.	Cylinders represented by test (Serial Nos.)	Yield strength (pounds per square inch)	Tensile strength (pounds per square inch)	Elongation (per cent in 8 inches)	Reduction of area (per cent)	Flattening test

(Signed)

(Place)

(Date)

RECORD OF HYDROSTATIC TESTS ON CYLINDERS

Numbered .. .. to ..... inclusive.

Size ..... inches outside diameter ..... inches long.

Made by ..... Company

For Company

[2] Lot numbers not over 500 cylinders in each lot, authorized for cylinders not over 2 inches outside diameter.

[3] Symbol in front of or following the number with ample space between is also authorized. Other variation in location authorized only when necessitated by lack of space.

Serial numbers of cylinders tested arranged numerically	Actual test pressure (pounds per square inch)	Total expansion (cubic centimetres)[1]	Permanent expansion (cubic centimetres)[1]	Per cent ratio of permanent expansion to total expansion[1]	Tare weight (pounds)[2]	Volumetric capacity
.....						

[1] If the tests are made by a method involving the measurement of the amount of liquid forced into the cylinder by the test pressure then the basic data, on which the calculations are made, such as the pump factors, temperature of liquid, coefficient of compressibility of liquid, etc., must also be given.

[2] Do not include removable cap but state whether with or without valve. These weights must be accurate to a tolerance of 1 per cent.

(Signed)

Specification 3E

SEAMLESS STEEL CYLINDERS

1. Compliance. (a) Required in all details.

2. Type, size, and service pressure. (a) Type and size. Seamless. Must have outside diameter not greater than 2 inches nominal, length less than 2 feet.

(b) Service pressure.[1] Must be 1,800 pounds per square inch.

3. Inspection by whom and where. (a) By competent and independent inspector approved by the Canadian Transport Commission.

(b) Except as provided in paragraph (c) of this section, for cylinders not made in Canada the tests, as specified, shall be made within the limits of Canada unless written permission is obtained from the Commission to conduct the tests elsewhere.

(c) Notwithstanding paragraph (b) of this section cylinders made within the United States of America shall not be transported by rail in Canada unless they have been fabricated and tested in complete accordance with the applicable CTC or DOT Specification under the supervision of a representative from an independent inspection agency approved by the Commission.

4. Duties of inspector. (a) inspect all material and reject any not complying with requirements; for cylinders made by billet-piercing process, billets to be inspected after nick and cold break.

(b) Verify chemical analysis of each heat of steel by analysis or by obtaining certified analysis: Provided, That check analysis of samples taken from one cylinder out of each lot of 200 or less is acceptable.

(c) Verify compliance of cylinders with all requirements including markings; inspect inside before closing in both ends; verify heat treatment as proper; obtain samples for all tests and check chemical analyses; witness all tests; verify threads by gauge; report volumetric capacity and tare weight (see report form) and minimum thickness of wall noted.

(d) Render complete report required by this specification to cylinder maker, Canadian Transport Commission and upon request to the purchaser.

5. Steel. (a) Open-hearth or electric steel of uniform quality. Content per cent for the following not over: Carbon, 0.55; phosphorus, 0.045; sulphur, 0.050.

6. Identification of steel. (a) Required; any suitable method.

7. Defects. (a) Material with seams, cracks, laminations, or other injurious defects, not authorized.

8. Manufacture. (a) By best appliances and methods; dirt and scale to be removed as necessary to afford proper inspection; no defect acceptable that is likely to weaken the finished cylinder appreciably; reasonably smooth and uniform surface finish required. The thickness of the spun bottom is, under no condition, to be less than two times the minimum wall thickness of the cylindrical shell; such bottom thickness to be measured within an area bounded by a line representing the points of contact between the cylinder and floor when the cylinder is in a vertical position.

9. Openings in cylinders and connections (valves, fuse plugs, etc.) for those openings. (a) Threads required to be clean cut, even, without checks, and to gauge.

(b) Taper threads, when used, to be of length not less than as specified for American Standard taper pipe threads.

(c) Straight threads having at least 4 engaged threads are authorized; to have tight fit and calculated shear strength at least 10 times the test pressure of the cylinder; gaskets required, adequate to prevent leakage.

10. Safety devices and protection for valves, safety devices, and other connections, if applied. (a) Must be as required by Canadian Transport Commission regulation that apply (see §§ 73.34(d) and 73.301(g)).

11. Hydrostatic test. (a) Cylinders must be tested as follows:

(1) One cylinder out of each lot of 500 or less to be subjected to hydrostatic pressure of 6,000 pounds per square inch or higher.

(2) The cylinder referred to in subparagraph (1) of this paragraph shall burst at a pressure higher than 6,000 pounds per square inch without fragmenting or otherwise showing lack of ductility, or shall hold a pressure of 12,000 pounds per square inch for 30 seconds without bursting, in which case it shall be subjected to a flattening test without cracking to six times wall thickness between knife edges, wedge shaped, 60 degree angle, rounded out to ½ inch radius.

NOTE 1: Inspector's report shall be suitably changed to show results of latter alternate and flattening tests.

(3) Other cylinders must be examined under pressure of at least 3,000 pounds per square inch and not to exceed 4,500 pounds per square inch and show no defect. Cylinders tested at a pressure in excess of 3,600 pounds per square

[1] The "service pressure" limits the use of the cylinder. It is shown by marks on cylinder; for example. CTC-3E1800 indicates the service pressure as 1,800 pounds per square inch.

inch shall burst at a pressure higher than 7,500 pounds per square inch when tested as specified in paragraph (a)(2) of this section. The pressure must be maintained for at least 30 seconds and sufficiently longer to insure complete examination.

12. Leakage test. (a) All spun cylinders and plugged cylinders (see Notes 1 and 2) must be tested for leakage by gas or air pressure after the bottom has been cleaned and is free from all moisture. Pressure, approximately the same as but no less than service pressure, must be applied to one side of the finished bottom over an area of at least 1/16 of the total area of the bottom but not less than ¾ inch in diameter including the closure, for at least one minute, during which time the other side of the bottom exposed to pressure must be covered with water and closely examined for indications of leakage. Leakers must be rejected. (See Note 1 to sec. 13).

NOTE 1: A spun cylinder is one in which an end closure in the finished cylinder has been welded by the spinning process.

NOTE 2: A plugged cylinder is one in which a permanent closure in the bottom of a finished cylinder has been effected by a plug.

NOTE 3: As a safety precaution, if the manufacturer elects to make this test before the hydrostatic test, he should design his apparatus so that the pressure is applied to the smallest area practicable, around the point of closure, and so as to use the smallest possible volume of air or gas.

13. Rejected cylinders. (a) Reheat treatment authorized; subsequent thereto, acceptable cylinders must pass all prescribed tests. Repair by welding or spinning is not authorized.

NOTE 1: Spun cylinders rejected under the provisions of sec. 12 may be removed from the spun cylinder category by drilling to remove defective material, tapping and plugging.

14. Marking. (a) Marking on each cylinder by stamping plainly and permanently as follows:

(1) CTC-3E1800.

(2) An identifying symbol (letters); location to be just following or below the CTC mark. The symbol must be that of purchaser, user or maker. The symbol must be registed with the Bureau of Explosives, through the Canadian Transport Commission, duplications unauthorized.

Example: CTC—3E1800
XY

(3) Date of test (such as 5-50 for May 1950).

15. Inspector's report. (a) Required to be clear, legible, and in following form:

(Place)
(Date)

Steel Gas Cylinders

Manufactured for .....Company

Location at

Manufactured by .....Company

Location at

Consigned to .....Company

Location at

Quantity

Size..... .....inches outside diameter by.....inches long.

Marks stamped into the shoulder of the cylinder are:

Specification CTC—3E1800

Serial numbers.....to ..... inclusive (if numbered).

Identifying symbol (registered)

Test date

These cylinders were made by process of

These steel used was identified by the following ....numbers
(heat-purchase order)

The steel used was verified as to chemical analysis and record thereof is attached hereto.

All material, such as plates, billets and seamless tubing, was inspected and each cylinder was inspected both before and after closing in the ends; all that was accepted was found free from seams, cracks, laminations and other defects which might prove injurious to the strength of the cylinder. The processes of manufacture and heat treatment were supervised and found to be efficient and satisfactory.

The cylinder walls were measured and the minimum thickness noted was..... inch. The tare weight per cylinder without valve is..... (approx.) The volumetric capacity per cylinder is.....(approx.)

Each and every cylinder was properly tapped with a taper thread; the threads were inspected and found to be clean-cut, of proper lenght, and correct as to gauge.

One finished cylinder out of each lot of 500 or less was taken at random and burst by interior pressure with the following results:

Date of test	Pressure at which cylinder ruptured

Each and every cylinder with bottom closed in by spinning was subjected to an interior gas pressure of at least 1,800 pounds per square inch and showed no leakage.

Each and every cylinder was subjected to an interior pressure of at least 3,000 pounds per square inch and showed no defect.

I hereby certify that all of these cylinders proved satisfactory in every way and comply with the requirements of the Canadian Transport Commission specification No. 3E except as follows:
Exceptions

.....
(Signed).....
Inspector

(Place)

(Date) ..

RECORD OF CHEMICAL ANALYSIS OF MATERIAL FOR CYLINDERS

Numbered.....to .....inclusive.

Size.....inches outside diameter by.....inches long.

Made by .....Company

For .....Company

Test No.	Heat No.	Check analysis No.	Cylinders represented (serial Nos.)	Chemical analysis						
				C	P	S	Si	Mn	Ni	Cr

The analyses were made by

(Signed)

(Place)

(Date).....

RECORD OF PHYSICAL TESTS OF MATERIAL FOR CYLINDERS

Numbered.....to.....inclusive.

Size.....inches outside diameter by.....inches long.

Made by .....Company

For .....Company

Test No.	Cylinders represented by test (Serial Nos.)	Yield strenght (pounds per square inch)	Tensile strength (pounds per square inch)	Elongation (per cent in 8 inches)	Reduction of area (per cent)	Flattening test

(Signed)

(Place)

(Date).....

RECORD OF HYDROSTATIC TESTS ON CYLINDERS

Numbered.....to.....inclusive.

Size.....inches outside diameter by.....inches long.

Made by .....Company

For Company

Serial numbers of cynlinders tested arranged numerically	Actual test pressure (pounds per square inch)	Total expansion (cubic centimetres)[1]	Permanent expansion (cubic centimetres)[1]	Per cent ratio of permanent expansion to total expansion[1]	Tare weight (pounds)[2]	Volumetric capacity

NOTE When specifications require test for only 1 out of each lot of 200 or less cylinders, the check on the others must be indicated by a notation hereon reading, "Each cylinder was subjected to a pressure of . . . . . pounds per square inch and showed no defect."

[1] If the tests are made by a method involving the measurement of the amount of liquid forced into the cylinder by the test pressure, then the basic data, on which the calculations are made, such as the pump factors, temperature of liquid, coefficient of compressibility of liquid, etc., must also be given.

[2] Do not include removable cap but state whether with or without valve. These weights must be accurate to a tolerance of 1 per cent.

(Signed) .....

Specification 3HT

INSIDE CONTAINERS SEAMLESS STEEL CYLINDERS

for aircraft use
made of definitely prescribed steel

1. Compliance. (a) Required in all details.

2. Type, size and service pressure. (a) Type and size. Seamless; not over 150 pounds water capacity (nominal).

(b) Service pressure.[1] At least 900 pounds per square inch.

[1] The "service pressure" limits the use of the cylinder. It is shown by marks on cylinder; for example, CTC 3HT2000 indicates the service pressure as 2,000 pounds per square inch.

3. Inspection by whom and where. By competent and independent Inspector approved by the Canadian Transport Commission. For cylinders not made in Canada, or the United States of America, the tests, as specified, shall be made within the limits of Canada, unless written permission is obtained from the Commission to conduct the tests elsewhere.

4. Duties of inspector. (a) Inspect all material and reject any not complying with requirements; for cylinders made by billet-piercing process, billets to be inspected after nick and cold break.

(b) Verify chemical analysis of each heat of material by analysis or by obtaining certified analysis: Provided, That a certificate from the manufacturer thereof, giving sufficient data to indicate compliance with requirements, is acceptable when verified by check analyses of samples taken from one cylinder out of each lot of 200 or less.

(c) Verify compliance of cylinders with all requirements including markings; inspect inside before closing in both ends; verify heat treatment as proper; obtain samples for all tests and check chemical analyses; witness all tests; verify threads by gauge; report volumetric capacity and tare weight (see report form) and minimum thickness of wall noted.

(d) Render complete report required by this specification to cylinder maker, Canadian Transport Commission and upon request to the purchaser.

5. Authorized steel. (a) Open hearth or electric furnace steel of uniform quality. Steel of the following chemical analysis is authorized (see notes 1 and 2):

Designation	AISI 4130 (per cent)
Carbon	0.28 0.33
Manganese	0.40 0.60
Phosphorus	0.040 maximum
Sulphur	0.040 maximum
Silicon	0.20 0.35
Chromium	0.80 1.10
Molybdenum	0.15 0.25

NOTE 1: A heat of steel made under the above specifications, check chemical analysis of which is slightly out of the specified range, is acceptable, if satisfactory in all other respects, provided the tolerances shown in the following table are not exceeded except as approved by the Commission.

CHECK ANALYSIS TOLERANCES

Element	Limit or maximum specified (per cent)	Tolerance (per cent) over the maximum limit or under the minimum limit	
		Under minimum limit	Over maximum limit
Carbon	Over 0.15 to 0.40 incl	0.03	0.04
Manganese	To 0.60 incl	0.03	0.03
Phosphorus*	All ranges	.....	0.01
Sulphur	All ranges	.....	0.01
Silicon	To 0.30 incl	0.02	0.03
	Over 0.30 to 1.00 incl	0.05	0.05
Chromium	To 0.90 incl	0.03	0.03
	Over 0.90 to 2.10 incl	0.05	0.05
Molybdenum	To 0.20 incl	0.01	0.01
	Over 0.20 to 0.40 incl	0.02	0.02

*Rephosphorized steels not subject to check analysis for phosphorus. NOTE 2: Grain size 6 or finer according to ASTM Spec. E19-46.

6. Identification of material. (a) Required; any suitable method. Steel stamping of heat identifications shall not be

made in any area which will eventually become the side wall of the cylinder. Depth of stamping shall not encroach upon the minimum prescribed wall thickness of the cylinder.

7. Defects. (a) Material with seams, cracks, laminations, severe inclusions, numerous or severe draw marks, or any other injurious defect not authorized.

8. Manufacture. (a) By best appliances and methods; dirt and scale to be removed as necessary to afford proper inspection; no fissure or other defect acceptable that is likely to weaken the finished container appreciably; the general surface finish shall not exceed a roughness of 250 RMS. Individual irregularities such as draw marks, scratches, pits, etc., should be held to a minimum consistent with good high stress pressure vessel manufacturing practices. If the cylinder is not originally free of such defects or does not meet the finish requirements, the surface may be machined or otherwise treated to eliminate these defects. The point of closure of cylinders closed by spinning is not to be less than two times the prescribed wall thickness of the cylindrical shell. Cylinder end contour shall be hemispherical or ellipsoidal with a ratio of major to minor axis not exceeding two to one and with concave side to pressure.

9. Welding or brazing. (a) Welding or brazing for any purpose whatsoever is prohibited except as follows:

(1) Welding by spinning is permitted to close the bottom of spun cylinders. Machining or grinding to produce proper surface finish at point of closure is required.

10. Wall thickness. (a) Minimum wall thickness for any cylinder shall be .050 inch.

(b) Minimum wall thickness shall be such that the wall stress at the minimum specified test pressure shall not exceed 75 per cent of the minimum tensile strength of the steel as determined from the physical tests required in paragraph 18 and shall not be over 105,000 psi.

(c) Calculations must be made by the formula:

$$S = \frac{P\,(1.3D^2 + 0.4d^2)}{D^2 \quad d^2}$$

where S=wall stress in pounds per square inch; P=minimum test pressure prescribed for water jacket test; D=outside diameter in inches; d=inside diameter in inches.

(d) Wall thickness of hemispherical bottoms only permitted to 90 per cent of minimum wall thickness of cylinder sidewall but shall not be less than .050 inch. In all other cases, thickness to be no less than prescribed minimum wall.

11. Heat treatment. (a) The completed cylinders must be uniformly and properly heated prior to tests. Heat treatment of the cylinders of the authorized analysis shall be as follows:

(1) All cylinders must be quenched by oil, or other suitable medium.

(2) The steel temperature on quenching shall be that recommended for the steel analysis, but in no case shall it exceed 1750°F.

(3) The steel shall be tempered at a temperature most suitable for the particular steel analysis but not less than 850°F.

(4) (Cancelled).

(5) All cylinders must be inspected by the magnetic particle or dye penetrant method to detect the presence of quenching cracks. Any cylinder found to have a quenching crack must be rejected and may not be requalified.

12. Openings in cylinders and connections (valves fuse plugs, etc.) for those openings. (a) Threads required to be clean cut, even, without cracks, and to gauge.

(b) Taper threads, when used, to be of length not less than as specified for National Gas Tapered Thread (NGT) as required by American Standard Compressed Gas Cylinder Valve Outlet and Inlet Connections.[1].

(c) Straight threads having at least 6 engaged threads are authorized; to have tight fit and a calculated shear stress of at least 10 times the test pressure of the cylinder; gaskets required, adequate to prevent leakage.

13. Safety devices and protection for valves, safety devices, and other connections, if applied. (a) Must be as required by the Commission's regulations that apply (see § § 73.34(d), 73.301(g) 73.302(a)(2), and 73.304(a)(2) Note 7.)

14. Hydrostatic test. (a) By water-jacket, or other suitable method, operated so as to obtain accurate data. Pressure gauge must permit reading to accuracy of 1 per cent. Expansion gauge must permit reading of total expansion to accuracy either of 1 per cent or .01 cubic centimer.

(b) Pressure must be maintained for 30 seconds and sufficiently longer to insure complete expansion. Any internal pressure applied after heat treatment and previous to the official test must not exceed 90 per cent of the test pressure. If due to failure of the test apparatus, the test pressure cannot be maintained, the test may be repeated at a pressure increased by 10 per cent or 100 pounds per square inch, whichever is the lower.

(c) Permanent volumetric expansion must not exceed 10 per cent of total volumetric expansion at test pressure.

(d) Each cylinder must be tested to at least 5/3 times service pressure.

15. Cycling tests. (a) Prior to the initial shipment of any specific cylinder design, cyclic pressurization tests shall have been performed on at least three representative samples without failure, as follows:

(1) Pressurization shall be performed hydrostatically between approximately zero psig and the service pressure at a rate not in excess of 10 cycles per minute. Adequate recording instrumentation shall be provided if equipment is to be left unattended for periods of time.

(b) Tests prescribed in paragraph 15(a)(1) shall be repeated on one random sample out of each lot of cylinders. Cylinder may then be subjected to burst test.

(c) A lot is defined as a group of cylinders fabricated from the same heat of steel, manufactured by the same process and heat treated in the same equipment under the same conditions of time, temperature, and atmosphere, and shall not exceed a quantity of 200 cylinders.

(d) All cylinders used in cycling tests must be destroyed.

16. Burst test. (a) One cylinder taken at random out of each lot of cylinders shall be hydrostatically tested to destruction.

17. Flattening test. (a) Between knife edges, wedge shaped, 60° angle, rounded to ½ inch radius, test one cylinder taken at random out of each lot of cylinders after hydrostatic test. Axis of cylinder must be at 90° angle to knife edges.

18. Physical tests. (a) To determine yield strength, tensile strength, elongation, and reduction of area of material.

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[1] Available for a nominal charge from the American Standards Association and the Compressed Gas Association, Inc.

Required on 2 specimens cut from 1 cylinder taken at random out of each lot of cylinders.

(b) Specimens must be: Gauge length at least 24 times thickness with width not over six times thickness. The specimen, exclusive of grip ends, must not be flattened. Grip ends may be flattened to within one inch of each end of the reduced section. When size of cylinder does not permit securing straight specimens, the specimens may be taken in any location or direction and may be straightened or flattened cold, by pressure only, not by blows; when specimens are so taken and prepared, the inspector's report must show in connection with record of physical test detailed information in regard to such specimens. Heating of specimen for any purpose is not authorized.

(c) The yield strength in tension shall be the stress corresponding to a permanent strain of 0.2 per cent of the gauge length.

(1) The yield strength shall be determined by either the "offset" method or the "extension under load" method as prescribed in ASTM standard E8-54T.

(2) In using the "extension under load" method, the total strain (or "extension under load") corresponding to the stress at which the 0.2 per cent permanent strain occurs may be determined with sufficient accuracy by calculating the elastic extension of the gauge length under appropriate load and adding thereto 0.2 per cent of the gauge length. Elastic extension calculations shall be based on an elastic modulus of 30,000,000. In the event of controversy, the entire stress-strain diagram shall be plotted and the yield strength determined from the 0.2 per cent offset.

(3) For the purpose of strain measurement, the initial strain shall be set while the specimen is under a stress of 12,000 pounds per square inch, the strain indicator reading being set at the calculated corresponding strain.

(4) Cross-head speed of the testing machine shall not exceed ⅛ inch per minute during yield strength determination.

19. Magnetic particle inspection. (a) Inspection shall be performed on inside of container before closing and externally on the finished container after heat treatment. Evidence of discontinuities, which in the opinion of a qualified inspector may appreciably weaken or decrease the durability of the cylinder, shall be cause for rejection.

20. Leakage test. (a) All spun cylinders and plugged cylinders (see Notes 1 and 2) must be tested for leakage by dry gas or dry air pressure after the bottom has been cleaned and is free from all moisture. Pressure, approximately the same as but no less than service pressure, must be applied to one side of the finished bottom over an area of at least 1/16 of the total area of the bottom but not less than ¾ inch in diameter, including the closure, for at least one minute, during which time the other side of the bottom exposed to pressure must be covered with water and closely examined for indications of leakage. Leakers must be rejected (see Notes 1, 2 and 3 and paragraph 22).

NOTE 1: A spun cylinder is one in which an end closure in the finished cylinder has been welded by the spinning process.

NOTE 2: A plugged cylinder is one in which a permanent closure in the bottom of a finished cylinder has been effected by a plug.

NOTE 3: As a safety precaution, if the manufacturer elects to make this test before the hydrostatic test, he should design his apparatus so that the pressure is applied to the smallest area practicable, around the point of closure, and so as to use the smallest volume of air or gas.

21. Acceptable results of tests. (a) Flattening required without cracking to ten times the wall thickness of the cylinder.

(b) Physical tests:

(1) Elongation at least 6 per cent in gauge length of 24 times wall thickness.

(2) Tensile strength shall not exceed 160,000 pounds per square inch.

(c) Burst pressure shall be at least 4/3 times the test pressure.

(d) Cycling—at least 10,000 pressurizations.

22. Rejected cylinders. (a) Reheat treatment authorized; subsequent thereto, acceptable cylinders must pass all prescribed tests. Repair by welding or spinning is not authorized.

23. Marking. (a) Cylinders shall be marked by low stress type steel stamping in an area and to a depth which will insure that the wall thickness measured from the root of the stamping to the interior surface is equal to or greater than the minimum prescribed wall thickness. Stamping must be permanent and legible. Stamping on side wall not authorized. The following markings shall appear:

(1) CTC-3HT followed by the service pressure (for example, CTC-3HT1800, etc.).

(2) A serial number and an identifying symbol (letters); location[1] of number to be just below or immediately following the CTC mark; location[1] of symbol to be just below or immediately following the number. The symbol and numbers must be those of purchaser, user, or maker. The symbol must be registered with the Bureau of Explosives through the Canadian Transport Commission, duplications unauthorized.

Examples:	CTC-3HT1800 1234 XY	CTC-3HT1800-1234-XY

(3) Inspector's official mark near serial number; date of test such as 5-59 for May 1959, so placed that dates of subsequent tests can be easily added; and word "SPUN" or "PLUG" near CTC mark when an end closure in the finished cylinder has been welded by the spinning process, or effected by plugging.

(4) Elastic expansion in cubic centimeters to the nearest 1 per cent near the date of test.

24. Name plates. (a) Authorized, provided that they can be permanently and securely attached to the cylinder. Attachment by either brazing or welding is not permitted. Attachment by soldering is permitted provided steel temperature does not exceed 500° F.

[1] Symbol in front of or following the number with ample space between is also authorized. Other variation in location authorized only when necessitated by lack of space.

25. Inspector's report. (a) Required to be clear, legible and in the following form:

(Place)

(Date)

Gas Cylinders

Manufactured for .....Company

Location at

Manufactured by.....Company

Location at

Consigned to .....Company

Location at

Quantity

Size

Size .....inches outside diameter by.....inches long.

Marks stamped into the shoulder of the cylinder are:

Specification CTC ....

Serial numbers .....to .....inclusive.

Inspector's mark .....

Identifying symbol (registered)

Test date

Tare weights (yes or no)

Other marks (if any) .....

These cylinders were made by process of

The cylinders were heat treated by the process of .....

The material used was identified by the following.....

(heat-purchase order)

numbers

The material used was verified as to chemical analysis and record thereof attached hereto. The heat numbers .....marked on the material.

(were—were not)

All material, such as plates, billets and seamless tubing, was inspected and each cylinder was inspected both before and after closing in the ends; all that was accepted was found free from seams, cracks, laminations, and other defects which might prove injurious to the strength of the cylinder. The processes of manufacture and heat treatment of cylinders were supervised and found to be efficient and satisfactory.

The cylinder walls were measured and the minimum thickness noted was.....inch. The outside diameter was determined by a close approximation to be.....inches. The wall stress was calculated to be.....pounds per square inch under an internal pressure of.....pounds per square inch.

Hydrostatic tests, flattening tests, tensile tests of material, and other tests, as prescribed in specification No. CTC-3HT were made in the presence of the inspector and all material and cylinders accepted were found to be in compliance with the requirements of that specification. Records thereof are attached hereto.

I hereby certify that all of these cylinders proved satisfactory in every way and comply with the requirements of the Canadian Transport Commission specification No. 3HT except as follows:

Exceptions:

(Signed) .....

Inspector.

(Place)..

(Date)

RECORD OF CHEMICAL ANALYSIS OF MATERIAL FOR CYLINDERS

Numbered .....to .....inclusive.

Size..... .....inches outside diameter by.....inches long.

Made by .....Company

For .....Company

NOTE: Any omission of analysis by heats, if authorized, must be accounted for by notation hereon reading "The prescribed certificate of the manufacturer of material has been secured, found satisfactory, and placed on file," or by attaching a copy of the certificate.

Test No.	Heat No.	Check analysis No.	Cylinders represented (Serial Nos.)	Chemical analysis								
				C	P	S	Si	Mn	Ni	Cr	Mo	Zr

The analyses were made by

(Signed)

(Place)...

(Date)

RECORD OF PHYSICAL TESTS OF MATERIAL FOR CYLINDERS

Numbered to inclusive.

Size .....inches outside diameter by .....inches long

Made by Company

For Company

Test No.	Cylinders represented by test (Serial Nos.)	Yield strength at 0,2 per cent offset (pounds per square inch)	Tensile strength (pounds per square inch)	Elongation (per cent in 8 inches)	Reduction of area (percent)	Flattening test

(Signed)

(Place).

(Date)

RECORD OF HYDROSTATIC TESTS IN CYLINDERS

Numbered to inclusive.

Size .....inches outside diameter by .....inches long

Made by .....Company

For .....Company

Serial numbers of cylinders tested arranged numerically	Actual test pressure (pounds per square inch)	Total expansion (cubic centimeters)[1]	Permanent expansion (cubic centimeters)[1]	Per cent ratio of permanent expansion to total expansion[1]	Tare weight (pounds)[2]	Volumetric capacity

[1] If the tests are made by a method involving the measurement of the amount of liquid forced into the cylinder by the test pressure, then the basic data, on which the calculations are made, such as the pump factors, temperature of liquid, coefficient of compressibility of liquid, etc., must also be given.

[2] Do not include removable cap but state whether with or without valve. These weights must be accurate to a tolerance of 1 per cent.

(Signed)

Specification 4AA480

Welded steel cylinders made of definitely prescribed steels.

1. Compliance. (a) Required in all details.

2. Type, size, and service pressure. (a) Must be welded type having not over 1000 pounds water capacity (nominal). Closures welded by spinning process not permitted.

(b) Service pressure 480 pounds per square inch.

3. Inspection by whom and where. (a) By competent and independent inspector approved by the Canadian Transport Commission.

(b) Except as provided in paragraph (c) of this section, for cylinders not made in Canada the tests, as specified, shall be made within the limits of Canada unless written permission is obtained from the Commission to conduct the tests elsewhere.

(c) Notwithstanding paragraph (b) of this section cylinders made within the United States of America shall not be transported by rail in Canada unless they have been fabricated and tested in complete accordance with the application CTC or DOT Specification under the supervision of a representative from an independent inspection agency approved by the Commission.

4. Duties of inspector. (a) Inspect all material and rejet any not complying with requirements of this specification. For cylinders made by the billet-piercing process, billets to be inspected after nick and cold break.

(b) Verify chemical analysis of each heat of material by analysis or by obtaining certified analysis: **Provided,** That a certificate from the manufacturer thereof, giving sufficient data to indicate compliance with requirements, is acceptable when verified by check analyses of samples taken from one cylinder out of each lot of 200 or less.

(c) Verify compliance of cylinders with specification requirements including markings, condition of inside, tests, threads, heat treatment. Obtain samples for all tests; check chemical analyses; witness all tests; report volumetric capacity, tare weight (see report form), and minimum thickness of wall noted.

(d) Render complete report required by this specification to cylinder maker, Canadian Transport Commission and upon request to the purchaser.

5. Steel. (a) The limiting chemical composition of steel authorized by this specification shall be as shown in sec. 20, Table 1.

6. Identification of material. (a) Required; any suitable method except that plates and billets for hot-drawn, cylinders shall be marked with the heat number.

7. Defects. (a) Material with seams, cracks, laminations, or other injurious defects, not authorized.

8. Manufacture. (a) By best appliances and methods: dirt and scale to be removed as necessary to afford proper inspection; no defect acceptable that is likely to weaken the finished cylinder appreciably; reasonably smooth and uniform surface finish required. Exposed bottom welds on cylinders over 18 inches long must be protected by footrings. Minimum thickness of heads and bottoms shall be not less than 90 per cent of the required thickness of the side wall. Seams must be made as follows:

(b) Circumferential seams: By welding. Brazing is not authorized.

(c) Longitudinal seams: Not permitted.

9. Welding. (a) The attachment to the tops and bottoms only of cylinders by welding of neckrings, footrings, bosses, pads, and valve protection rings is authorized provided that such attachments are made of weldable steel, the carbon content of which does not exceed 0.25 per cent.

10. Wall thickness. (a) For outside diameters over 5 inches the minimum wall thickness shall be 0.078 inch. In any case the minimum wall thickness shall be such that the calculated wall stress at minimum test pressure (sec. 14) shall not exceed the lesser value of either of the following:

(1) One-half of the minimum tensile strength of the material determined as required in sec. 15, or,

(2) 35,000 pounds per square inch.

(b) Calculation must be made by the formula:

$$S = \frac{P\,(1.3D^2 + 0.4d^2)}{D^2 - d^2}$$

where:

S = wall stress in pounds per square inch;
P = minimum test pressure prescribed for water-jacket test;
D = outside diameter in inches;
d = inside diameter in inches.

(c) Cylinders with wall thickness less than 0.100 inch, the ratio of tangential length to outside diameter shall not exceed 4.0.

11. Heat treatment. (a) Each cylinder must be uniformly and properly heat treated prior to test. Any suitable heat treatment in excess of 1100°F., is authorized, except that liquid quenching is not permitted. Heat treatment must be accomplished after all forming and welding operations.

(b) Heat treatment is not required after welding weldable low carbon parts to attachments of similar material which have been previously welded to the top or bottom of cylinders and properly heat treated, provided such subsequent welding does not produce a temperature in excess of 400°F., in any part of the top or bottom material.

12. Openings in cylinders. (a) All openings must be in the heads or bases.

(b) Each opening in cylinders, except those for safety devices, must be provided with a fitting boss, or pad, securely attached to cylinder by welding or by threads. If threads are used they must comply with the following:

(1) Threads must be clean-cut, even, without checks and cut to gauge.

(2) Taper threads to be of length not less than as specified for American Standard taper pipe threads.

(3) Straight threads having at least 6 engaged threads, to have tight fit and calculated shear strength at least 10 times the test pressure of the cylinder; gaskets required, adequate to prevent leakage.

(c) Closure of fitting boss or pad must be adequate to prevent leakage.

13. Safety devices and protection for valves, safety devices and other connections, if applied. (a) Must be as required by the Commission's regulations that apply (see §§ 73.34(d), 73.124(a), and 73.301(g)).

14. Hydrostatic test. (a) By water-jacket, or other suitable method, operated so as to obtain accurate data. Pressure gauge must permit reading to accuracy of 1 per cent. Expansion gauge must permit reading of total expansion to accuracy of either 1 per cent or 0.1 cubic centimetre.

(b) Pressure must be maintained for at least 30 seconds or sufficiently longer to assure complete expansion. Any internal pressure applied after heat-treatment and before the official test must not exceed 90 percent of the test pressure. If, due to failure of test apparatus, the test pressure cannot be maintained, the test may be repeated at a pressure increased by 10 per cent or 100 pounds per square inch, whichever is lower.

(c) Permanent volumetric expansion must not exceed 10 percent of the total volumetric expansion at test pressure.

(d) Cylinders must be tested as follows:

(1) At least one cylinder selected at random out of each lot of 200 or less must be tested as described in paragraphs (a), (b), and (c) of this section, to at least two times service pressure. If a selected cylinder fails, then two additional specimens must be selected at random from the same lot and subjected to the prescribed test. If either of these fails the test, then each cylinder in that lot must be so tested; and

(2) Each cylinder not tested as prescribed in subparagraph (1) of this paragraph must be examined under pressure of at least two times service pressure and must show no defect. A cylinder showing a defect must be rejected unless it is requalified under paragraph 18.

15. Physical test. (a) To determine yield strength, tensile strength, elongation, and reduction of area of material. Required on 2 specimens cut from one cylinder having passed the hydrostatic test, or part thereof heat-treated as required, taken at random out of each lot of 200 or less.

(b) Specimens must be: Gauge length 8 inches with width not over 1½ inches; or, gauge length 2 inches with width not over 1½ inches, provided that gauge length at least 24 times thickness with width not over 6 times thickness is authorized when cylinder wall is not over 3/16 inch thick. The specimen, exclusive of grip ends, must not be flattened. Grip ends may be flattened to within one inch of each end of the reduced section. When size of cylinder does not permit securing straight specimens, the specimens may be taken in any location or direction and may be straightened or flattened cold, by pressure only, not by blows; when specimens are so taken and prepared, the inspector's report must show in connection with record of physical tests detailed information in regard to such specimens. Heating of specimen for any purpose is not authorized.

(c) The yield strength in tension shall be the stress corresponding to a permanent strain of 0.2 per cent of the gauge length.

(1) The yield strength shall be determined by either the "offset" method or the "extension under load" method as prescribed in ASTM Standard E8-57T.

(2) In using the "extension under load" method, the total strain (or "extension under load"), corresponding to the stress at which the 0.2 per cent permanent strain occurs may be determined with sufficient accuracy by calculating the elastic extension of the gauge length under appropriate load and adding thereto 0.2 per cent of the gauge length. Elastic extension calculations shall be based on an elastic modulus of 30,000,000. In the event of controversy, the entire stress-strain diagram shall be plotted and the yield strength determined from the 0.2 per cent offset.

(3) For the purpose of strain measurement, the initial strain reference shall be set while the specimen is under a stress of 12,000 pounds per square inch, the strain indicator reading being set at the calculated corresponding strain.

(4) Cross-head speed of the testing machine shall not exceed ⅛ inch per minute during yield strength determination.

16. Elongation. (a) Physical test specimens must show at least 40 per cent for 2-inch gauge length or at least 20 per cent in other cases, except that these elongation percentages may be reduced numerically by 2 for 2-inch specimens and by 1 in other cases for each 7,500 pounds per square inch increment of tensile strength above 50,000 pounds per square inch to a maximum of four such increments.

17. Tests of welds. (a) Tensile test. A specimen shall be cut from one cylinder of each lot of 200 or less, or welded test plate.[1] The specimen shall be taken across the major seam and shall be prepared and tested in accordance with and must meet requirements of CGA Pamphlet C-3[2]. Should this specimen fail to meet the requirements, specimens may be taken from two additional cylinders or welded test plates from the same lot and tested. If either of the latter specimens fail to meet the requirements, the entire lot represented shall be rejected.

(b) Guided bend test. A "root" bend test specimen shall be cut from the cylinder or welded test plate, used for the tensile test specified in paragraph 17 (a). Specimens shall be taken across the major seam and shall be prepared and tested in accordance with and shall meet the requirements of CGA Pamphlet C-3[2].

(c) Alternate guided-bend test. This test may be used and shall be as required by CGA Pamphlet C-3[2]. The specimen shall be bent until the elongation at the outer surface, adjacent to the root of the weld, between the lightly scribed gauge lines-a to b, shall be at least 20 per cent, except that this percentage may be reduced for steels having a tensile strength in excess of 50,000 pounds per square inch, as provided in paragraph 16(a).

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[1] The welded test plate shall be of one of the heats in the lot of 200 or less which it represents, in the same condition and approximately the same thickness as the cylinder wall except that in no case shall it be of lesser thickness than that required for a one-quarter size Charpy impact specimen. The weld must be made by the same procedure and subjected to the same heat treatment as the major weld on the cylinder.

[2] Available from the Compressed Gas Association, Inc., 500 Fifth Avenue, New York, New York 10036.

18. Rejected cylinders. (a) Reheat treatment authorized; subsequent thereto, acceptable cylinders must pass all prescribed tests. Repair of welded seams by welding is authorized.

19. Marking. (a) Marking on each cylinder stamped as follows:

(1) CTC 4AA480.

(2) A serial number and an identifying symbol, both to be of the purchaser, user, or maker. The symbol must be registered with the Bureau of Explosives through the Canadian Transport Commission; duplications unauthorized.

(3) Inspector's official mark.

(4) Date of test (such as 1-54 for January 1954).

(5) Additional markings are permitted.

(b) Sequence of marks. Number shall be just below or immediately following the CTC mark; identifying symbol shall be just below or immediately following the number; inspector's official mark shall be near the serial number. Date of test shall be so placed that dates of subsequent tests can easily be added. Symbol in front of the number, with space between, or symbol and serial number stamped into welded valve spud directly above the CTC mark located on head of cylinder are also authorized. Other variations in sequence of marks authorized only when necessitated by lack of space.

(c) Location of markings. Markings may be stamped plainly and permanently in the following locations on the cylinder:

(1) On shoulders and top heads not less than 0.087 inch thick.

(2) On neck, valve boss, valve protection sleeve, or similar part permanently attached to top end of cylinder.

(3) On a plate attached to the top of the cylinder or permanent part thereof; sufficient space must be left on the plate to provide for stamping at least six retest dates; the plate must be at least 1/16 inch thick and must be attached by welding, or by brazing at a temperature of at least 1100°F., throughout all edges of the plate.

(4) Variations in location of markings authorized only when necessitated by lack of space.

(d) Size of marks. Space permitting, at least ¼ inch high.

20. Authorized steel. (a) As specified in Table 1 of Appendix A.

21. Inspector's report. (a) Required to be clear, legible and in the following form:

(Place)

(Date)

Steel gas cylinders

Manufactured for

Location at

Manufactured by

Location at

Consigned to

Location at

Quantity

Size ..... inches outside diameter by ..... inches long.

Marks stamped into the ..... of the cylinder are:
(Location of marking)

Specification CTC

Serial numbers ..... to ..... inclusive.

Inspector's mark

Identifying symbol (registered)

Test date

Tare weights (yes or no)

Other marks

These cylinders were made by process of

The material used was type ..... authorized in table I of Spec. No. 4AA480.

The material used was identified by the following ..... numbers
(heat-purchase order)

The material used was verified as to chemical analysic and record thereof is attached hereto. The heat numbers
(were—were not)
marked on the material.

All material was inspected and all that was accepted was found free from seams, cracks, laminations and other injurious defects.

The compliance of cylinders with specification requirements was verified including markings, condition of inside, tests, threads, etc. All cylinders with defects which might prove injurious were rejected. The processes of manufacture and heat treatment were supervised and found to be efficient and satisfactory.

The cylinder walls were measured and the minimum thickness noted was .....inch. The outside diameter was determined by a close approvimation to be .....inches. The wall stress was calculated to be.....pounds per square inch under an internal pressure of ..... pounds per square inch.

Hydrostatic tests, tensile tests of material, and other tests as prescribed in specification CTC4AA 480 were made in the presence of the inspector and all cylinders accepted were found to be in compliance with the requirements of that specification. Records thereof are attached hereto.

Each cylinder .....been equipped with safety devices as follows:
(has—has not)

I hereby certify that all of those cylinders proved satisfactory in every way and comply with the requirements of Canadian Transport Commission specification No. 4AA480 except as follows:

Exceptions .....

.....

(Manufacturer's name)

(Signed) .....

(Inspector)

By

(Place)

(Date)

RECORD OF CHEMICAL ANALYSIS OF STEEL FOR CYLINDERS

Numbered.....to.....inclusive.

Size.....inches outside diameter by.....inches long.

Made by Company

For .....Company

Test No.	Heat No.	Check analysis No.	Cylinders represented (serial Nos.)	Chemical Analysis										
				C	P	S	Si	Mn	Ni	Cr	Mo	Cu	Al	Zr

Steel was manufactured by.....Company.

The originals of the certified mill test reports are in the files of the manufacturer.

NOTE: Any omission of analyses by heats, if authorized, must be accounted for by notation hereon reading "The prescribed certificate of the manufacturer of material has been secured, found satisfactory, and placed on file", or by attaching a copy of the certificate.

Chemical analyses were made by

(Place)

(Date)

RECORD OF PHYSICAL TESTS OF MATERIAL FOR CYLINDERS

Numbered.....to.....inclusive.

Size.....inches outside diameter by.....inches long.

Made by .....Company

For Company

Test No.	Cylinder represented by test (serial Nos.)	Yield strength (pounds per square inch)	Tensile strength (pounds per square inch)	Elongation (per cent in inches)	Reduction of area (per cent)	Weld tensile test	Weld bend test

(Signed).....

(Place).....

(Date).....

RECORD OF HYDROSTATIC TESTS ON CYLINDERS

Numbered. .....to.....inclusive.

Size.....inches outside diameter by.....inches long.

Made by Company

For Company

Serial Nos. of cylinders tested arranged numerically	Actual test pressure (pounds per square inch)	Total expansion (cubic centimetres)[1]	Permanent expansion (cubic centimetres)[1]	Per cent ratio of permanent expansion to total expansion[1]	Tare weight (pounds)[2]	Volumetric capacity[3]

NOTE: When specifications require test for only 1 out of each lot of 200 or less cylinders, the check on the others must be indicated by a notation hereon reading. "Each cylinder was subjected to a pressure of.....pounds per square inch and showed no defect."

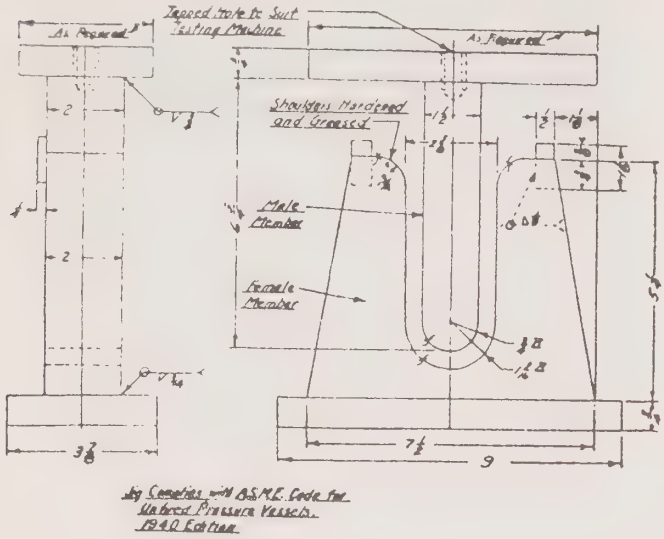
[1] If the tests are made by a method involving the measurement of the amount of liquid forced into the cylinder by the test pressure, then the basic data, on which the calculations are made, such as the pump factors, temperature of liquid, coefficient of compressibility of liquid, etc. must also be given.

[2] Do not include removable cap but state whether with or without valve. These weights must be accurate to a tolerance of 1 per cent.

[3] Report approximate maximum and minimum volumetric capacity for the lot.

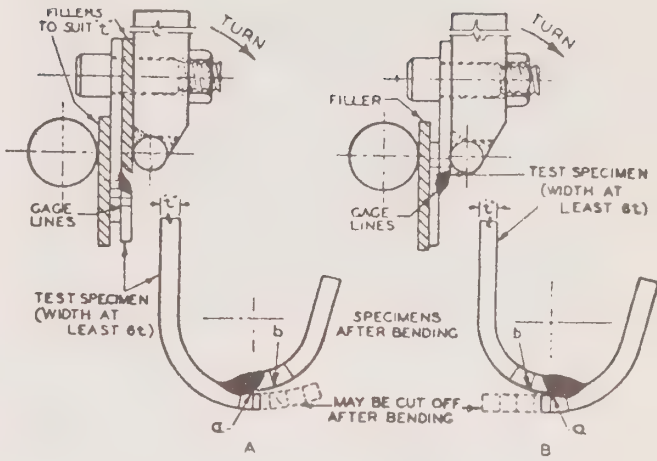
(Signed)....

22. Guided bend test jig. (a) Dimensions as follows:

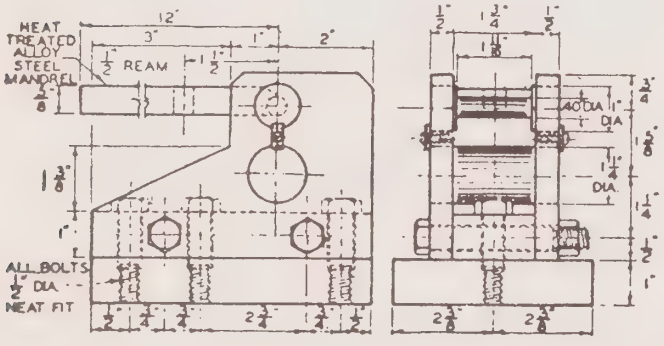


NOTE: Dimensions shown for die and plunger are for ⅜″ thick material only. The following dimensions shall be used for other thicknesses. Thickness of plunger member = 4 × thickness of test specimen. Radius of plunger member = 2 × thickness of test specimen. Width of opening, die member = 6 × thickness of test specimen + 1/8″. Radius of member = 3 × thickness of test specimen + 1/16″.

23. (a) cont.

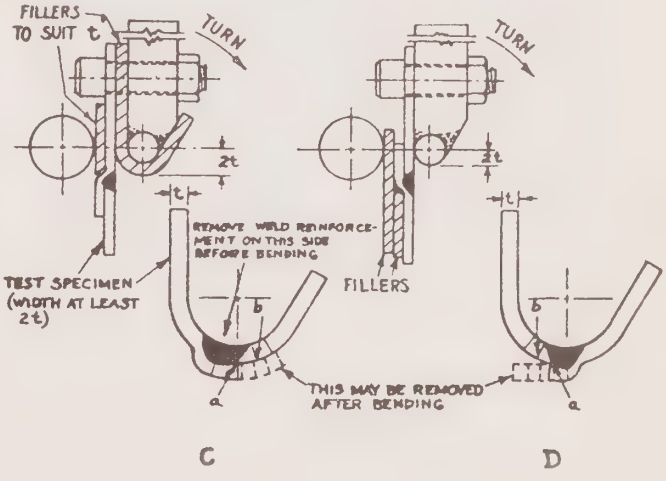


23. Alternate guided bend test jig. (a) Dimensions as follows:



NOTE: Dimensions shown are suitable for bending lap-weld specimens of 0.05″ to 0.133″ material thickness. A piece of 2″ pipe may be slipped over the mandrel for turning. For any specimen thickness, fillers of appropriate thickness shall be added to one or both sides of the specimen as shown to obtain the required elongation.

23. (b) Alternate guided bend test jig. Dimensions as follows:



Specification 4B

WELDED AND BRAZED STEEL CYLINDERS

1. Compliance. (a) Required in all details.

2. Type, size, and service pressure. (a) Type and size. Must be welded or brazed type; longitudinal seams must be forge lap-welded or brazed; not over 1,000 pounds water capacity (nominal). Cylinders closed in by spinning process not authorized.

(b) Service pressure:[3] At least 150 to not over 500 pounds per square inch.

3. Inspection by whom and where. (a) By competent and independent inspector approved by the Canadian Transport Commission.

(b) Except as provided in paragraph (c) of this section, for cylinders not made in Canada the tests, as specified, shall be made within the limits of Canada unless written permission is obtained from the Commission to conduct the tests elsewhere.

(c) Notwithstanding paragraph (b) of this section cylinders made within the United States of America shall not be transported by rail in Canada unless they have been fabricated and tested in complete accordance with the applicable CTC or DOT Specification under the supervision of a representative from an independent inspection agency approved by the Commission.

4. Duties of Inspector. (a) Inspect all material and reject any not complying with requirements; for cylinders made by billet-piercing process, billets to be inspected after nick and cold break.

(b) Verify chemical analysis of each heat of material by analysis or by obtaining certified analysis: **Provided,** That a certificate from the manufacturer thereof, giving sufficient data to indicate compliance with requirements, is acceptable when verified by check analyses of samples taken from one cylinder out of each lot of 200 or less.

(c) Verify compliance of cylinders with all requirements including markings; inspect inside before closing in both ends; verify heat treatment as proper; obtain samples for all tests and check chemical analyses; witness all tests; verify threads by gauge; report volumetric capacity and tare weight (see report form) and minimum thickness of wall noted.

(d) Render complete report required by this specification to cylinder maker, Canadian Transport Commission and upon request to the purchaser.

5. Steel. (a) Open-hearth, electric or basic oxygen process steel of uniform quality. Content per cent for the following not over: carbon, 0.25; phosphorus, 0.045; sulphur, 0.050.

6. Identification of material. (a) Required; any suitable method except that plates and billets for hot-drawn cylinders shall be marked with heat number.

7. Defects. (a) Material with seams, cracks, laminations, or other injurious defects, not authorized.

8. Manufacture. (a) By best appliances and methods; dirt and scale to be removed as necessary to afford proper inspection; no defect acceptable that is likely to weaken the finished cylinder appreciably; reasonably smooth and uniform surface finish required. Exposed bottom welds on cylinders over 18" long must be protected by footrings. Seams must be made as follows:

(1) Circumferential seams: By welding or by brazing Heads attached by brazing must have a driving fit with the shell, unless the shell is crimped, swedged, or curled over the skirt or flange of the head, and be thoroughly brazed until complete penetration by the brazing material of the brazed joint is secured. Depth of brazing from end of shell must be at least four times the thickness of shell metal.

(2) Longitudinal seams in shells: By forged lap welding, by copper brazing, by copper alloy brazing, or by silver alloy brazing. Copper alloy composition must be: Copper, 95 per cent minimum; Silicon, 1.5 per cent to 3.85 per cent; Manganese, 0.25 per cent to 1.10 per cent. The melting point of the silver alloy brazing material must be in excess of 1000°F. When brazed, the plate edge must be lapped at least eight times the thickness of plate, laps being held in position, substantially metal to metal, by riveting or electric spot-welding; brazing must be done by using a suitable flux and by placing brazing material on one side of seam and applying heat until this material shows uniformly along the seam of the other side.

9. Welding or brazing. (a) The attachment to the tops and bottoms only of cylinders by welding or brazing of neckrings, footrings, handles, bosses, pads and valve protection rings is authorized: **Provided,** That such attachments and the portion of the container to which they are attached are made of weldable steel, the carbon content of which must not exceed 0.25 per cent except in the case of 4130X steel which may be used with proper welding procedure.

10. Wall thickness. (a) For outside diameters over 6" the minimum wall thickness shall be 0.090 inch. In any case the minimum wall thickness shall be such that calculated wall stress at minimum test pressure (section 14(d)) shall not exceed the following values:

(1) 24,000 pounds per square inch for cylinders without longitudinal seam;

(2) 22,800 pounds per square inch for cylinders having copper brazed or silver alloy brazed longitudinal seam;

(3) 18,000 pounds per square inch for cylinders having forged lapped welded longitudinal seam.

(b) Calculation must be made by the formula:

$$S = \frac{P\,(1.3D^2 + 0.4d^2)}{D^2 - d^2}$$

where:

S = wall stress in pounds per square inch;
P = minimum test pressure prescribed for water-jacket test or 450 pounds per square inch whichever is the greater;
D = outside diameter in inches;
d = inside diameter in inches.

[3] The "service pressure" limits the use of the cylinder. It is shown by marks on cylinder; for example, CTC-4B300 indicates the service pressure as 300 pounds per square inch.

11. Heat treatment. (a) Body and heads formed by drawing or pressing must be uniformly and properly heat-treated

12. Opening in cylinders. (a) Each opening in cylinders, except those for safety devices, must be provided with a fitting, boss, or pad, securely attached to cylinder by brazing or by welding or by threads. Fitting, boss, or pad must be of steel suitable for the method of attachment employed, and which need not be identified or verified as to analysis, except that if attachment is by welding, carbon content must not exceed 0.25 per cent. If threads are used, they must comply with the following:

(1) Threads must be clean cut, even, without checks, and tapped to gauge.

(2) Taper threads to be of length not less than as specified for American Standard taper pipe threads.

(3) Straight threads, having at least 4 engaged threads, to have tight fit and calculated shear strength at least 10 times the test pressure of the cylinder; gaskets required, adequate to prevent leakage.

NOTE 1. A brass fitting may be brazed to the steel boss or flange on cylinders used as component parts of hand fire extinguishers.

(b) Closure of fitting, boss, or pad must be adequate to prevent leakage.

13. Safety devices and protection for valves, safety devices, and other connections, if applied. (a) Must be as required by the Canadian Transport Commission regulations that apply (see §§ 73.34(d), 73.124(a) and 73.301(g)).

14. Hydrostatic test. (a) By water-jacket, or other suitable method, operated so as to obtain accurate data. Pressure gauge must permit reading to accuracy of 1 per cent. Expansion gauge must permit reading of total expansion to accuracy either of 1 per cent or 0.1 cubic centimetre.

(b) Pressure must be maintained for 30 seconds and sufficiently longer to insure complete expansion. Any internal pressure applied after heat-treatment and previous to the official test must not exceed 90 per cent of the test pressure. If, due to failure of the test apparatus, the test pressure cannot be maintained, the test may be repeated at a pressure increased by 10 per cent or 100 pounds per square inch, whichever is the lower.

(c) Permanent volumetric expansion must not exceed 10 per cent of total volumetric expansion at test pressure.

(d) Cylinders must be tested as follows:

(1) At least one cylinder selected at random out of each lot of 200 or less shall be tested as outlined in paragraphs (a), (b) and (c) of this section to at least two times service pressure.

(2) All cylinders not tested as outlined in subparagraph (d)(1) of this section must be examined under pressure of at least two times service pressure and show no defect.

15. Flattening test. (a) Between knife edges, wedge shaped, 60° angle, rounded to ½″ radius; test 1 cylinder[1] taken at random out of each lot of 200 or less, after hydrostatic test.

16. Physical test. (a) To determine yeld strength, tensile strength, elongation, and reduction of area of material. Required on 2 specimens cut from 1[1] cylinder, or part thereof heat-treated as required, taken at random out of each lot of 200 or less.

(b) Specimens must be: Gauge length 8 inches with width not over 1½ inches; or, gauge length 2 inches with width not over 1½ inches; provided, that gauge length at least 24 times thickness with width not over 6 times thickness is authorized when cylinder wall is not over 3/16 inch thick. The specimen, exclusive of grip ends, must not be flattened. Grip ends may be flattened to within one inch of each end of the reduced section. When size of cylinder does not permit securing straight specimens, the specimens may be taken in any location or direction and may be straightened or flattened cold, by pressure only, not by blows; when specimens are so taken and prepared, the inspector's report must show in connection with record of physical tests detailed information in regard to such specimens. Heating of specimen for any purpose is not authorized.

(c) The yield strength in tension shall be the stress corresponding to a permanent strain of 0.2 per cent of the gauge length.

(1) The yield strength shall be determined by either the "offset" method or the "extension under load" method as prescribed in ASTM Standard E8-57T.

(2) In using the "extention under load" method, the total strain (or "extension under load") corresponding to the stress at which the 0.2 per cent permanent strain occurs may be determined with sufficient accuracy by calculating the elastic extension of the gauge length under appropriate load and adding thereto 0.2 per cent of the gauge length. Elastic extension calculations shall be based on an elastic modulus of 30,000,000. In the event of controversy, the entire stress-strain diagram shall be plotted and the yield strength determined from the 0.2 per cent offset.

(3) For the purpose of strain measurement, the initial strain shall be set while the specimen is under a stress of 12,000 pounds per square inch, the strain indicator reading being set at the calculated corresponding strain.

(4) Cross-head speed of the testing machine shall not exceed ⅛ inch per minute during yield strength determination.

17. Acceptable results for physical and flattening tests. (a) Elongation at least 40 per cent for 2 inch gauge length or at least 20 per cent in other cases; yield strength not over 73 per cent of tensile strength; flattening test not required.

EXCEPTION: Flattening test is required, without cracking, to 6 times wall thickness when cylinders are made of lap-welded pipe; in such case rings (crop ends) cut from each end of pipe must be tested with weld 45° or less from point of greatest stress; if a ring fails, another from the same end of pipe may be tested.

18. Rejected cylinders. (a) Reheat treatment authorized; subsequent thereto, acceptable cylinders must pass all prescribed tests. Repair of brazed seams by brazing and welded seams by welding is authorized.

19. Marking. (a) Marking on each cylinder by stamping plainly and permanently on shoulder, top head, neck or

[1] For lots of 30 or less, physical and flattening tests are authorized to be made on a ring at least 8 inches long cut from each cylinder and subjected to same heat treatment as the finished cylinder.

valve protection collar which is permanently attached to the cylinders and forming an integral part thereof, provided that cylinders not less than 0.090 inches thick may be stamped on the side wall adjacent to top head, as follows:

(1) CTC-4B followed by the service pressure (for example, CTC-4B300, etc.).

(2) A serial[4] number and an identifying symbol (letters); location[5] of number to be just below or immediately following the CTC mark; location[5] of symbol to be just below or immediately following the number. The symbol and numbers must be those of purchaser, user, or maker. The symbol must be registered with the Bureau of Explosives through Canadian Transport Commission; duplications unauthorized.

Examples: CTC-4B300 CTC-4B300-1234-XY
1234
XY

(3) Inspector's official mark, near serial number; date of test (such as 5-50 for May 1950), so placed that date of subsequent test can be easily added.

20. Size of marks. (a) At least ¼″ high if space permits.

21. Inspector's report. (a) Required to be clear, legible, and in following form:

(Place).....
(Date)

Gas Cylinders

Manufactured for .....Company
Location at .....
Manufactured by .....Company
Location .....
Consigned to .....Company
Location at
Quantity .....
Size .....inches outside diameter by .....inches long.
Marks stamped into the shoulder of the cylinder are:
Specification CTC .....
Serial numbers .....to ..... inclusive.
Inspector's mark
Identifying symbol (registered)
Test date
Tare weights (yes or no)
Other marks (if any) .....
These cylinders were made by process of .....

The .....permitted
(neckrings - footrings, etc.)
in sec. 9 were attached by process of

(welding—brazing)
The material used was identified by the following .....numbers
(heat-purchase order)

The material used was verified as to chemical analysis and record thereof is attached hereeto. The heat numbers .....
(were—were not)
marked on the material.

All material, such as plates, billets and seamless tubing was inspected and each cylinder was inspected both before and after closing in the ends; all that was accepted was found free from seams, cracks, laminations, and other defects which might prove injurious to the strength of the cylinder. The processes of manufacture and heat treatment of cylinders were supervised and found to be efficient and satisfactory.

The cylinder walls were measured and the minimum thickness noted was.....inch. The outside diameter was determined by a close approximation to be.....inches. The wall stress was calculated to be.....pounds per square inch under an internal pressure of.....pounds per square inch.

Hydrostatic tests, flattening tests, tensile tests of material, and other tests as prescribed in specification No. CTC—4B were made in the presence of the inspector and all material and cylinders accepted were found to be in compliance with the requirements of that specification. Records thereof are attached hereto.

I hereby certify that all of these cylinders proved satisfactory in every way and comply with the requirements of Canadian Transport Commission specification No. 4B except as follows:
Exceptions

(Signed) .....
(Inspector)

(Place) .....
(Date) .....

RECORD OF CHEMICAL ANALYSIS OF MATERIAL FOR CYLINDERS

Numbered.....to.....inclusive.
Size.....inches outside diameter by.....inches long.
Made by .....Company
For .....Company

NOTE: Any ommission of analyses by heats, if authorized, must be accounted for by notation hereon reading "The prescribed certificate of the manufacturer of material has been secured, found satisfactory, and placed on file," or by attaching a copy of the certificate.

Test No.	Heat No.	Check analysis No.	Cylinders represented (serial Nos.)	Chemical analysis						
				C	P	S	Si	Mn	Ni	Cr

The analyses were made by.....
(Signed)

(Place)
(Date)

RECORD OF PHYSICAL TESTS OF MATERIAL FOR CYLINDERS

Numbered..... to. .....inclusive.
Size.....inches outside diameter by..... inches long.
Made by .....Company
For .....Company

Test No.	Cylinders represented by test (Serial Nos.)	Yield strenght (pounds per square inch)	Tensile strength (pounds per square inch)	Elongation (per cent in 8 inches)	Reduction of area (per cent)	Flattening test

(Signed)

[4] Lot numbers, not over 500 cylinders in each lot, authorized for cylinders not over 2 inches outside diameter and for cylinders over 2 inches outside diameter when the volumetric capacity does not exceed 170 cubic inches.

[5] Symbol in front of or following the number with ample space between or symbol and serial number stamped into welded or brazed-on valve spud directly above the CTC specification mark located on head of cylinder are also authorized. Other variations in location authorized only when necessitated by lack of space.

(Place)
(Date)

RECORD OF HYDROSTATIC TESTS ON CYLINDERS

Numbered.....to.....inclusive.
Size.....inches outside diameter by.....inches long.
Made by .....Company
For .....Company

Serial numbers of cylinders tested arranged numerically	Actual test pressure (pounds per square inch)	Total expansion (cubic centimetres)[1]	Permanent expansion (cubic centimetres)[1]	Per cent ratio of permanent expansion to total expansion[1]	Tare weight (pounds)[2]	Volumetric capacity[3]

NOTE: When specifications require test for only 1 out of each lot of 200 or less cylinders, the check on the others must be indicated by notation hereon reading, "Each cylinder was subjected to a pressure of..... pounds per square inch and showed no defect."

[1] If the test are made by a method involving the measurement of the amount of liquid forced into the cylinder by the test pressure, then the basic data, on which the calculations are made, such as the pump factors, temperature of liquid, coefficient of compressibility of liquid, etc., must also be given.

[2] Do not include removable cap but state whether with or without valve. These weights must be accurate to a tolerance of 1 per cent.

[3] Report approximate maximum and minimum volumetric capacity for the lot.

(Signed)

Specification 4B240-FLW

WELDED OR WELDED AND BRAZED CYLINDERS WITH FUSION-WELDED LONGITUDINAL SEAM

1. Compliance. (a) Required in all details.

2. Type, size, and service pressure. (a) Type and size. Must be welded or brazed type with longitudinal fusion-welded seam. 240 pounds nominal water capacity. Cylinders closed in by spinning process not authorized.

(b) Service pressure.[3] 240 pounds per square inch.

3. Inspection by whom and where. By competent and independent Inspector approved by the Canadian Transport Commission. For cylinders not made in Canada, or the United States of America, the tests, as specified, shall be made within the limits of Canada, unless written permission is obtained from the Commission to conduct the tests elsewhere.

[3] The "service pressure" limits the use of the cylinder. It is shown by marks on cylinder; for example, CTC-4B240-FLW.

4. Duties of inspector. (a) Inspect all material and reject any not complying with requirements.

(b) Verify chemical analysis of each heat of material by analysis or by obtaining certified analysis: **Provided,** That a certificate from the manufacturer thereof, giving sufficient data to indicate compliance with requirements, is acceptable when verified by check analyses of samples taken from one cylinder out of each lot of 200 or less.

(c) Verify compliance of cylinders with all requirements including markings; inspect inside before closing in both ends; verify heat treatment as proper; obtain samples for all tests and check chemical analyses; witness all tests; verify threads by gauge; report volumetric capacity and tare weight (see report form) and minimum thickness of wall noted.

(d) Render complete report required by this specification to cylinder maker, Canadian Transport Commission and upon request to the purchaser.

5. Steel. (a) Steel shall be plain carbon steel of American Society for Testing Materials firebox quality with carbon content not in excess of 0.25 per cent.

6. Identification of material. (a) Required; any suitable method.

7. Defects. (a) Material with seams, cracks, laminations, or other injurious defects, not authorized.

8. Manufacture. (a) By best appliances and methods; dirt and scale to be removed as necessary to afford proper inspection; no defect acceptable that is likely to weaken the finished cylinder appreciably; reasonably smooth and uniform surface finish required. Exposed bottom welds on cylinders over 18" long must be protected by footrings. Seams must be made as follows:

(1) Circumferential seams by welding or by brazing: Heads attached by brazing must have a driving fit with the shell, unless the shell is crimped, swedged, or curled over the skirt or flange of the head, and be thoroughly brazed until complete penetration by the brazing material of the brazed joint is secured. Depth of brazing from end of shell must be at least four times the thickness of shell metal.

(2) Longitudinal fusion-welded seam shall be of the double-welded butt type. Filler metal may be added from one side when and if means are provided for accomplishing complete penetration and reinforcement on both sides of the joint. For welding the cylinder, procedure and operators must be qualified in accordance with the sections that apply in CGA Pamphlet C-3.

9. Welding or brazing. (a) The attachment to the tops and bottoms only of cylinders by welding or brazing of neckrings, footrings, handles, bosses, pads, and valve protection rings is authorized provided that such attachments and the portion of the container to which they are attached and made of weldable steel, the carbon content of which must not exceed 0.25 per cent.

10. Wall thickness. (a) For outside diameters over 5 inches the minimum wall thickness shall be 0.090 inch. In any case the minimum wall thickness shall be such that calculated wall stress at 480 pounds per square inch shall not exceed 18,000 pounds per square inch.

(b) Calculation must be made by the formula: insert

$$S = \frac{P\,(1.3D^2 + 0.4d^2)}{D^2 - d^2}$$

where:

S = wall stress in pounds per square inch;
P = 480 pounds per square inch;
D = outside diameter in inches;
d = inside diameter in inches.

11. Heat treatment. (a) Each cylinder shall be thermally stress-relieved after all initial welding and seam repair welding operations have been completed and prior to the hydrostatic test.

12. Openings in cylinders. (a) Each opening in cylinders, except those for safety devices, must be provided with a fitting, boss, or pad, securely attached to cylinder by brazing or by welding or by threads. Fitting, boss, or pad must be of steel suitable for the method of attachment employed, and which need not be identified or verified as to analysis, except that if attachment is by welding, carbon content must not exceed 0.25 per cent. If threads are used, they must comply with the following:

(1) Threads must be clean cut, even, without checks, and tapped to gauge.

(2) Taper threads to be of length not less than as specified for American Standard taper pipe threads.

(3) Straight threads, having at least 4 engaged threads, to have tight fit and calculated shear strength at least 10 times the test pressure of the cylinder; gaskets required, adequate to prevent leakage.

(b) Closure of fitting, boss, or pad must be adequate to prevent leakage.

13. Safety devices and protection for valves, safety devices, and other connections, if applied. (a) Devices must be as required by the Canadian Transport Commission regulations that apply (see §§ 73.34 (d) and 73.301 (g)).

14. Hydrostatic test. (a) By water-jacket, or other suitable method, operated so as to obtain accurate data. Pressure gauge must permit reading to accuracy of 1 per cent. Expansion gauge must permit reading of total expansion to accuracy either of 1 per cent or 0.1 cubic centimetre.

(b) Pressure must be maintained for 30 seconds and sufficiently longer to insure complete expansion. Any internal pressure applied after heat-treatment and previous to the official test must not exceed 90 per cent of the test pressure. If, due to failure of the test apparatus, the test pressure cannot be maintained, the test may be repeated at a pressure increased by 10 per cent or 100 pounds per square inch, whichever is the lower.

(c) Permanent volumetric expansion must not exceed 10 per cent of total volumetric expansion at test pressure.

(d) Each cylinder shall be subjected to the hydrostatic test and test pressure shall be at least two and two-thirds times the service pressure. Following this test, each cylinder shall be subjected to a dry air-pressure test of two times the service pressure. The cylinder shall be thoroughly dry before air test is applied, and during test welded seams shall be examined for leaks, either by submerging the cylinders in liquid, or by painting all welded seams with a solution suitable for the detection of leaks.

(e) One finished cylinder out of each lot, which appears to the inspector to be the least likely to meet the test, shall be selected by the inspector from each lot of 200 or less successively produced and shall be hydrostatically tested to destruction and shall not burst at a pressure less than six times the service pressure.

15. Physical test. (a) To determine yield strength, tensile strength, elongation, and reduction of area of material. Required on 2 specimens cut from 1[1] cylinder, or part thereof heat-treated as required, taken at random out of each lot of 200 or less.

(b) Specimens must be: Gauge length 8 inches with width not over 1½ inches; or, gauge length 2 inches with width not over 1½ inches; Provided, That gauge length at least 24 times thickness with width not over 6 times thickness is authorized when cylinder wall is not over 3/16 inch thick. The specimen, exclusive of grip ends, must not be flattened. Grip ends may be flattened to within one inch of each end of the reduced section. When size of cylinder does not permit securing straight specimens, the specimens may be taken in any location or direction and may be straightened or flattened cold, by pressure only, not by blows; when specimens are so taken and prepared, the inspector's report must show in connection with record of physical tests detailed information in regard to such specimens. Heating of specimen for any purpose is not authorized.

(c) The yield strength in tension shall be the stress corresponding to a permanent strain of 0.2 per cent of the gauge length.

(1) The yield strength shall be determined by either the "offset" method or the "extension under load" method as prescribed in ASTM Standard E8-57T.

(2) In using the "extension under load" method, the total strain (or "extension under load") corresponding to the stress at which the 0.2 per cent permanent strain occurs may be determined with sufficient accuracy by calculating the elastic extension of the gauge length under appropriate load and adding thereto 0.2 per cent of the gauge length. Elastic extension calculations shall be based on an elastic modulus of 30,000,000. In the event of controversy, the entire stress-strain diagram shall be plotted and the yield strength determined from the 0.2 per cent offset.

(3) For the purpose of strain measurement, the initial strain shall be set while the specimen is under a stress of 12,000 pounds per square inch, the strain indicator reading being set at the calculated corresponding strain.

(4) Cross-head speed of the testing machine shall not exceed ⅛ inch per minute during yield strength determination.

16. Acceptable results for physical tests. (a) Elongation at least 40 per cent for 2 inch gauge length or at least 20 per cent in other cases; yield strength not over 73 per cent of tensile strenght; flattening test not required.

[1] For lots of 30 or less, physical tests are authorized to be made on a ring at least 8 inches long cut from each cylinder and subjected to same heat treatment as the finished cylinder.

17. Weld tests. (a) Guided bend test. A "root" bend test specimen shall be cut from the cylinder or welded test plate, used for the tensile test specified in paragraph 15(a). Specimens shall be taken across the major seam and shall be prepared and tested in accordance with and shall meet the requirements of CGA Pamphlet C-3.

(b) In addition to the guided bend test, a reduced section tension test shall be made transverse to the weld. The tensile strength shall be not less than 100 per cent of the minimum of the specified tensile range of the base material used. Should this specimen fail to meet the requirements two additional specimens from the same cylinder shall be tested and if either of these fail to meet the requirements, the entire lot represented shall be rejected.

18. Radiographic examination. (a) The techniques and acceptability of radiographic inspection shall conform to the standards set forth in CGA Pamphlet C-3.

(b) Cylinders must be examined as follows:

(1) One finished longitudinal seam shall be selected at random from each lot of 100 or less successively produced and be radiographed throughout its entire length. Should the radiographic examination fail to meet the requirements of paragraph (a) of this section, two additional seams of the same lot shall be examined, and if either of these fail to meet the requirements, each cylinder may be examined as outlined above; only those passing are acceptable.

19. Rejected cylinders. (a) Reheat treatment authorized; subsequent thereto, acceptable cylinders must pass all prescribed tests. Repair of brazed seams by brazing and welded seams by welding is authorized.

20. Marking. (a) Marking required on each cylinder by stamping plainly and permanently on shoulder, top head, or neck as follows:

(1) CTC-4B240-FLW.

(2) A serial number and an identifying symbol (letters) location[2] of number to be just below or immediately following the CTC mark; location[2] of symbol to be just below or immediately following the number. The symbol and numbers must be those of purchaser, user, or maker. The symbol must be registered with the Bureau of Explosives through the Canadian Transport Commission; duplications unauthorized.

Examples: CTC-4 B240-FLW 1234 XY CTC-4 B240 FLW-1234-XY

(3) Inspector's official mark near serial number, date of test (such as 12-50 for December 1950), so placed that dates of subsequent test can be easily added.

21. Size of marks. (a) At least ¼" high if space permits.

22. Inspector's report. (a) Required to be clear, legible, and in following form:

[2] Symbol in front of or following the number with ample space between or symbol and serial number stamped into welded or brased-on valve spud directly above the CTC specification mark located on head of cylinder are also authorized. Other variations in location authorized only when necessitated by lack of space.

(Place)
(Date

Gas Cylinders
Manufactured for _____ Company
Location at
Manufactured by _____ Company
Location at
Consigned to _____ Company
Location at
Quantity.....
Size .....inches outside diameter by _____ inches long.
Marks stamped into the shoulder of the cylinder are:
Specification CTC .....
Serial numbers _____ to _____ inclusive.
Inspector's mark
Identifying symbol (registered)
Test date
Tare weights (yes or no)
Other marks (if any) .....
These cylinders were made by process of.....

.....
The.....permitted

In sec. 9 (neckrings, footrings, etc.) were attached by process of
.....
(welding—brasing)
The material used was idendified by the following ..... numbers
(heat-purchase order)

The material used was verified as to chemical analysis and record thereof is attached hereto. The heat numbers
(were—were not)
marked on the material.

All material, such as plates, billets and seamless tubing, was inspected and each cylinder was inspected both before and after chosing in the ends; all that was accepted was found free from seams, cracks, laminations, and other defects which might prove injurious to the strenght of the cylinder. The processes of manufacture and heat treatment of cylinders were supervised and found to be efficient and satisfactory.

The cylinder walls were measured and the minimum thickness noted was.....inch. The outside diameter was determined by a close approximation to.....inches. The wall stress was calculated to be.....pounds per square inch under an internal pressure of .....pounds per spare inch.

Hydrostatic test, tensile tests of material, and other tests, as prescribed in specification No. CTC-4B240-FLW were made in the presence of the inspector and all material and cylinders accepted were found to be in compliance with the requirements of that specification. Records thereof are attached hereto.

I hereby certify that all of these cylinders proved satisfactory in every way and comply with the requirements of Canadian Transport Commission specification No. 4B240-FLW except as follows:
Exceptions

(Signed) _____ Inspector.

(Place)
(Date

RECORD OF CHEMICAL ANALYSIS OF MATERIAL FOR CYLINDERS

Numbered.....to.....inclusive.
Size.....inches outside diameter by .....inches long.
Made by .....Company
For .....Company

NOTE. Any emission of analyses by heats, if authorized, must be accounted for by notation hereon reading, "The prescribed certificate of the manufacturer of material has been secured, found satisfactory, and placed on file," or by attaching a copy of the certificate.

Test No.	Heat No.	Check analysis No.	Cylinders represented (serial Nos.)	Chemical analysis						
				C	P	S	Si	Mn	Ni	Cr

The analyses were made by

(Signed)

(Place)

(Date)

RECORD OF PHYSICAL TESTS OF MATERIAL FOR CYLINDERS

Numbered..... to..... inclusive.
Size..... inches outside diameter by ..... inches long.
Made by ..... Company
For ..... Company

Test No.	Cylinders represented by test (serial Nos.)	Yield strenght (pounds per square inch)	Tensile strength (pounds per square inch)	Elongation (per cent in 8 inches)	Reduction of area (per cent)

(Signed)

(Place)
(Date)

RECORD OF WELD AND BURST TESTS

Numbered..... to..... inclusive.
Size..... inches outside diameter by..... inches long.
Made by ..... Company
For ..... Company

Test No.	Cylinders represented by test (Serial Nos.)	Root bend test acceptable (yes or no)	Transverse test acceptable (yes or no)	Radiographic examination acceptable (yes or no)	Burst test (pounds per square inch)

Radiographic technique employed consisted of

(Signed)

(Place)

(Date)

RECORD OF HYDROSTATIC TESTS ON CYLINDERS

Numbered..... to..... inclusive.
Size..... inches outside diameter by..... inches long.
Made by ..... Company
For ..... Company

Serial numbers of cylinders tested arranged numerically	Actual test pressure (pounds per square inch)	Total expansion (cubic centimetres)[1]	Permanent expansion (cubic centimetres)[1]	Per cent ratio of permanent expansion to total expansion[1]	Tare weight (pounds)[2]	Volumetric capacity[3]

[1] If the tests are made by a method involving the measurement of the amount of liquid forced into the cylinder by the test pressure, then the basic data, on which the calculations are made, such as the pump factors, temperature of liquid, coefficient of compressibility of liquid, etc., must also be given.

[2] Do not include removable cap but state whether with or without valve. These weights must be accurate to a tolerance of 1 per cent.

[3] Report approximate maximum and minimum volumetric capacity for the lot.

(Signed)

Specification 4BA

WELDED OR BRAZED STEEL CYLINDERS MADE OF DEFINITELY PRESCRIBED STEELS

1. Compliance. (a) Required in all details.

2. Type, size, and service pressure. (a) Must be welded or brazed type; not over 1000 pounds water capacity (nominal); service pressure at least 225 and not over 500 pounds per square inch gauge. Closures welded by the spinning process not permitted.

3. Inspection by whom and where.

(a) By competent and independent inspector approved by the Canadian Transport Commission.

(b) Except as provided in paragraph (c) of this section, for cylinders not made in Canada the tests, as specified, shall be made within the limits of Canada unless written permission is obtained from the Commission to conduct the tests elsewhere.

(c) Notwithstanding paragraph (b) of this section cylinders made within the United States of America shall not be transported by rail in Canada unless they have been fabricated and tested in complete accordance with the applicable CTC or DOT Specification under the supervision of a representative from an independent inspection agency approved by the Commission.

4. Duties of inspector. (a) Inspect all material and reject any not complying with requirements of this specification. For cylinders made by the billet-piercing process, billets to be inspected after nick and cold break.

(b) Verify chemical analysis of each heat of material by analysis or by obtaining certified analysis: Provided, That a certificate from the manufacturer thereof, giving sufficient data to indicate compliance with requirements, is acceptable when verified by check analyses of samples taken from one cylinder out of each lot of 200 or less.

(c) Verify compliance of cylinders with specification requirements including: markings; condition of inside; tests; threads; heat treatment. Obtain samples for all tests, and check chemical analyses, witness all tests; report volumetric capacity, tare weight (see report form), and minimum thickness of wall noted.

(d) Render complete report required by this specification to cylinder maker, Canadian Transport Commission and upon request to the purchaser.

5. Steel. (a) Designations and limiting chemical compositions of steels authorized by this specification shall be as shown in sec. 20, Table I.

6. Identification of material. (a) Required; any suitable method except that plates and billets for hot-drawn cylinders shall be marked with the heat number.

7. Defects. (a) Material with seams, cracks, laminations, or other injurious defects, not authorized.

8. Manufacture. (a) By best appliances and methods; dirt and scale to be removed as necessary to afford proper inspection; no defect acceptable that is likely to weaken the finished cylinder appreciably; reasonably smooth and uniform surface finish required. Exposed bottom welds on cylinders over 18 inches long must be protected by footrings. Minimum thickness of heads and bottoms shall be not less than 90 per cent of the required thickness of the side wall. Seams must be made as follows:

(b) Circumferential seams. By welding or by brazing. Heads attached by brazing must have a driving fit with the shell, unless the shell is crimped, swedged, or curled over the skirt or flange of the head, and must be thoroughly brazed until complete penetration by the brazing material of the brazed joint is secured. Depth of brazing from end of shell must be at least four times the thickness of shell metal.

(c) Longitudinal seams in shells: By copper brazing, copper alloy brazing or by silver alloy brazing. Copper alloy composition must be: Copper 95 per cent minimum, Silicon 1.5 per cent to 3.85 per cent, Manganese 0.25 per cent to 1.10 per cent. The melting point of the silver alloy brazing material must be in excess of 1000°F. The plate edge must be lapped at least eight times the thickness of plate, laps being held in position, substantially metal to metal, by riveting or by electric spot-welding. Brazing must be done by using a suitable flux and by placing brazing material on one side of seam and applying heat until this material shows uniformly along the seam of the other side.

(1) Strength of longitudinal seam: Copper brazed longitudinal seam must have strength at least 3/2 times the strength of the steel wall.

9. Welding and brazing. (a) The attachment to the tops and bottoms only of cylinders by welding or brazing of neckrings, footrings, handles, bosses, pads, and valve protection rings is authorized provided that such attachments and the portion of the container to which they are attached are made of weldable steel, the carbon content of which must not exceed 0.25 per cent except in the case of 4130X steel which may be used with proper welding procedure.

10. Wall thickness. (a) For outside diameters over 6" the minimum wall thickness shall be 0.078". In any case the minimum wall thickness shall be such that the calculated wall stress at minimum test pressure (sec. 14) shall not exceed the lesser value of any of the following:

(1) The value shown in Table I, sec. 20, for the particular material under consideration;

(2) One-half of the minimum tensile strength of the material determined as required in sec. 15;

(3) 35,000 pounds per square inch.

(4) Further provided that wall stress for cylinders having copper brazed longitudinal seams must not exceed 95 per cent of any of the above values. Measured wall thickness shall not include galvanizing or other protective coating.

(b) Calculation must be made by the formula:

$$S = \frac{P\,(1.3D^2 + 0.4d^2)}{D^2 - d^2}$$

where:

S = wall stress in pounds per square inch;
P = minimum test pressure prescribed for water-jacket test;
D = outside diameter in inches;
d = inside diameter in inches.

(c) Cylinders with wall thickness less than 0.100", the ratio of tangential length to outside diameter shall not exceed 4.0.

11. Heat treatment. (a) Each cylinder must be uniformly and properly heat treated prior to test by the applicable method shown in sec. 20, Table I. Heat treatment must be accomplished after all forming and welding operations, except that when brazed joints are used, heat treatment must follow any forming and welding operations, but may be done before, during or after the brazing operations.

(b) Heat treatment is not required after welding or brazing weldable low carbon parts to attachments of similar material which have been previously welded or brazed to the top or bottom of cylinders and properly heat treated, provided such subsequent welding or brazing does not produce a temperature in excess of 400°F. in any part of the top or bottom material.

12. Openings in cylinders. (a) All openings must be in the heads or bases.

(b) Each opening in cylinders, except those for safety devices, must be provided with a fitting, boss, or pad, securely attached to cylinders by brazing, by welding, or by threads. If threads are used they must comply with the following:

(1) Threads must be clean-cut, even, without checks and cut to gauge.

(2) Taper threads to be of length not less than as specified for American Standard taper pipe threads.

(3) Straight threads, having at least 4 engaged threads, to have tight fit and calculated shear strength at least 10 times the test pressure of the cylinder; gaskets required, adequate to prevent leakage.

(c) Closure of fitting, boss, or pad must be adequate to prevent leakage.

13. Safety devices and protection for valves, safety devices and other connections, if applied. (a) Must be as required by the Canadian Transport Commission Regulations that apply. (See §§ 73.34(d), 73.124(a) and 73.301(g)).

14. Hydrostatic test. (a) By water-jacket, or other suitable method, operated so as to obtain accurate data. Pressure gauge must permit reading to accuracy of 1 per cent. Expansion gauge must permit reading of total expansion to accuracy either of 1 per cent or 0.1 cubic centimetre.

(b) Pressure must be maintained for 30 seconds and sufficiently longer to insure complete expansion. Any internal pressure applied after heat treatment and previous to the official test must not exceed 90 per cent of the test pressure.

(c) Permanent volumetric expansion must not exceed 10 per cent of the total volumetric expansion at test pressure.

(d) Cylinders must be tested as follows:

(1) At least one cylinder selected at random out of each lot of 200 or less shall be tested as outlined in paragraphs (a), (b), and (c) of this section to at least two times service pressure.

(2) All cylinders not tested as outlined in subparagraph (d) (1) of this section must be examined under pressure of at least two times service pressure and show no defect.

15. Physical test. (a) To determine yield strength, tensile strength, elongation, and reduction of area of material. Required on 2 specimens cut from one cylinder having passed the hydrostatic test, or part thereof heat-treated as required, taken at random out of each lot of 200 or less.

(b) Specimens must be: Gauge length 8 inches with width not over 1½ inches; or, gauge length 2 inches with width not over 1½ inches, provided, that gauge length at least 24 times thickness with width not over 6 times thickness is authorized when cylinder wall is not over 3/16 inch thick. The specimen, exclusive of grip ends, must not be flattened. Grip ends may be flattened to within one inch of each end of the reduced section. When size of cylinder does not permit securing straight specimens, the specimens may be taken in any location or direction and may be straightened or flattened cold, by pressure only, not by blows; when specimens are so taken and prepared, the inspector's report must show in connection with record of physical tests detailed information in regard to such specimens. Heating of specimen for any purpose is not authorized.

(c) The yield strength in tension shall be the stress corresponding to a permanent strain of 0.2 per cent of the gauge length.

(1) The yield strength shall be determined by either the "offset" method or the "extension under load" method as prescribed in ASTM Standard E8-57T.

(2) In using the "extension under load" method, the total strain (or "extension under load"), corresponding to the stress at which the 0.2 per cent permanent strain occurs may be determined with sufficient accuracy by calculating the elastic extension of the gauge length under appropriate load and adding thereto 0.2 per cent of the gauge length. Elastic extension calculations shall be based on an elastic modulus of 30,000,000. In the event of controversy, the entire stress-strain diagram shall be plotted and the yield strength determined from the 0.2 per cent offset.

(3) For the purpose of strain measurement, the initial strain reference shall be set while the specimen is under a stress of 12,000 pounds per square inch, the strain indicator reading being set at the calculated corresponding strain.

(4) Cross-head speed of the testing machine shall not exceed ⅛ inch per minute during yield strength determination.

16. Elongation. (a) Physical test specimens must show at least 40 per cent for 2-inch gauge length or at least 20 per cent in other cases, except that these elongation per centages may be reduced numerically by 2 for 2-inch specimens and by 1 in other cases for each 7,500 pounds per square inch increment of tensile strength above 50,000 pounds per square inch to a maximum of four such increments.

17. Tests. Weld test. (Does not apply to brazed seams.)

(a) Tests of welds. Tensile test. A specimen shall be cut from one cylinder of each lot of 200 or less, or welded test plate.[1] The specimen shall be taken across the major seam and shall be prepared and tested in accordance with and must meet the requirements of CGA Pamphlet C-3. If either of the latter specimens fail to meet the requirements, the entire lot represented shall be rejected.

(b) Guided bend test. A "root" bend test specimen shall be cut from the cylinder or welded test plate, used for the tensile test specified in paragraph 17(b). Specimens shall be taken across the major seam and shall be prepared and tested in accordance with and shall meet the requirements of CGA Pamphlet C-3.

(c) Alternate guided-bend test. This test may be used and shall be as required by CGA Pamphlet C-3. The specimen shall be bent until the elongation at the outer surface, adjacent to the root of the weld, between the lightly scribed gauge lines-a to b, shall be at least 20 per cent, except that this percentage may be reduced for steels having a tensile strength in excess of 50,000 pounds per square inch, as provided in paragraph 16(a).

18. Rejected cylinders. (a) Reheat treatment authorized; subsequent thereto, acceptable cylinders must pass all prescribed tests. Repair of brazed seams by brazing and welded seams by welding is authorized.

19. Marking. (a) Marking on each cylinder stamped as follows:

(1) CTC-4BA followed by the service pressure (for example, CTC-4BA240, etc.).

(2) A serial number and an identifying symbol, both to be of the purchaser, user, or maker. The symbol must be registered with the Bureau of Explosives through the Canadian Transport Commission. Duplication unauthorized. Lot numbers in place of serial numbers authorized for cylinders not over 2 inches outside diameter or for cylinders with volumetric capacity not exceeding 60 cubic inches.

(3) Inspector's official mark.

(4) Date of test (such as 4-50 for April 1950).

(5) Additional markings are permitted.

(b) Sequence of marks. Number shall be just below or immediately following the CTC mark; identifying symbol shall be just below or immediately following the number; inspector's official mark shall be near the serial number. Date of test shall be so placed that dates of subsequent test can easily be added. Symbol in front of or following the number with space between, or symbol and serial number stamped into welded or brazed-on valve spud directly above the CTC mark located on head of cylinder are also authorized. Other variations in sequence of

[1] The welded test plate shall be of one of the heats in the lot of 200 or less which it represents, in the same condition and approximately the same thickness as the cylinder wall except that in no case shall it be of lesser thickness than that required for a one-quarter size Charpy impact specimen. The weld must be made by the same procedure and subjected to the same heat treatment as the major weld on the cylinder.

marks authorized only when necessitated by lack of space.

(c) Location of markings. Markings may be stamped plainly and permanently in the following locations on the cylinder:

(1) On shoulders and top heads not less than 0.087 inch thick.

(2) On side wall adjacent to top head for side walls not less than 0.090 inch thick.

(3) On neck, valve boss, valve protection sleeve, or similar part permanently attached to top end of cylinder.

(4) On a plate attached to the top of the cylinder or permanent part thereof; sufficient space must be left on the plate to provide for stamping at least six retest dates; the plate must be at least 1/16 inch thick and must be attached by welding, or by brazing at a temperature of at least 1100°F., throughout all edges of the plate.

(5) On a cylindrical portion of the shell which extends beyond the recessed bottom of the cylinder constituting an integral and nonpressure part of the cylinder.

(6) Variations in location of markings authorized only when necessitated by lack of space.

(d) Size of marks. Space permitting, at least ¼ inch high.

20. Authorized steel. (a) As specified in Table 1 of Appendix A.

21. Inspector's report. (a) Required to be clear, legible and in following form:

(Place)
(Date)

Steel gas cylinders
Manufactured for
Location at
Manufactured by
Location at
Consigned to
Location at
Quantity .....
Size ..... inches outside diameter by inches long.
Marks stamped into the
(Location of marking)
of the cylinder are:
Specification CTC .....
Serial numbers ..... to ..... inclusive.
Inspector's mark .....
Identifying symbol (registered)
Test date
Tare weights (yes or no)
Other marks

These cylinders were made by process of

The material used was type .....authorized in Table 1 of spec. No. 4BA.

The material used was identified by the following ..... numbers
(heat-purchase order)

The material used was verified as to chemical analysis and record thereof is attached hereto. The heat numbers
(were—were not)
marked on the material.

All material was inspected and all that was accepted was found free from seams, cracks, laminations and other injurious defects.

The compliance of cylinders with specification requirements was verified including markings, condition of inside, tests, threads, etc. All cylinders with defects which might prove injurious were rejected. The processes of manufacture and heat treatment were supervised and found to be efficient and satisfactory.

The cylinder walls were measured and the minimum thickness noted was..... inch. The outside diameter was determined by a close approximation to be. .....inches. The wall stress was calculated to be.....pounds per square inch under an internal pressure of.....pounds per square inch.

Hydrostatic tests, tensile tests of material, and other tests as prescribed in specification No. CTC-4BA.....were made in the presence of the inspector and all cylinders accepted were found to be in compliance with the requirements of that specification. Records thereof are attached hereto.

Each cylinder .....been equipped
(has—has not)
with safety devices as follows:

I hereby certify that all of these cylinders proved satisfactory in every way and comply with the requirements of Canadian Transport Commission specification No. 4BA except as follows:

Exceptions

.....
(Manufacturer's name) (Signed)

By..... Inspector.

(Place)

(Date)

RECORD OF CHEMICAL ANALYSIS OF STEEL FOR CYLINDERS

Numbered.....to.....inclusive.

Size.....inches outside diameter by.....inches long.

Made by .....Company

For Company

Test No.	Heat No.	Check analysis No.	Cylinders represented (Serial Nos.)	Chemical analysis										
				C	P	S	Si	Mn	Ni	Cr	Mo	Cu	Al	Zr

Steel was manufactured by..... Company. The originals of the certified mill test reports are in the files of the manufacturer.

NOTE: Any omission of analyses by heats, if authorized, must be accounted for by notation hereon reading "The prescribed certificate of the manufacturer of material has been secured, found satisfactory, and placed on file," or by attaching a copy of the certificate.

Chemical analyses were made by .....
(Place).....
(Date)

RECORD OF PHYSICAL TESTS OF MATERIAL FOR CYLINDERS

Numbered.....to.....inclusive.

Size.....inches outside diameter by.....inches long.

Made by Company

For .....Company

Test No.	Cylinders represented by test (Serial Nos.)	Yield strength (pounds per square inch)	Tensile strength (pounds per square inch	Elongation (per cent in inches)	Reduction of area (per cent)	Weld tensile test	Weld bend test

(Signed)

(Place)
(Date)

RECORD OF HYDROSTATIC TESTS ON CYLINDERS

Numbered .. to .... inclusive.

Size . ... inches outside diameter by .. ..inches long.

Made by ....Company

For ... . Company

Serial numbers of cylinders tested arranged numerically	Actual test pressure (pounds per square inch)	Total expansion (cubic centimetres)[1]	Permanent expansion (cubic centimetres)[1]	Per cent ratio of permanent expansion to total expansion[1]	Tare weight (pounds)[2]	Volumetric capacity[3]

NOTE: When specifications require test for only 1 out of each lot of 200 or less cylinders, the check on the others must be indicated by a notation hereon reading. "Each cylinder was subjected to a pressure of ....pounds per square inch and showed no defect."

[1] If the tests are made by a method involving the measurement of the amount of liquid forced into the cylinder by the test pressure, then the basic data, on which the calculations are made, such as the pump factors, temperature of liquid, coefficient of compressibility of liquid, etc., must also be given.

[2] Do not include removable cap but state whether with or without valve. These weights must be accurate to a tolerance of 1 per cent.

[3] Report approximate maximum and minimum volumetric capacity for the lot.

(Signed)

Specification 4B240ET

WELDED AND BRAZED CYLINDERS MADE FROM ELECTRIC RESISTANCE WELDED TUBING

1. Compliance. (a) Required in all details.

2. Type, spinning process, size and service pressure. (a) Type. Cylinders must be of brazed type made from electric resistance welded tubing.

(b) Spinning process. Cylinders closed in by spinning process authorized.

(c) Size. The maximum water capacity of this type shall not exceed 12 pounds or 333 cubic inches. The maximum outside diameter of the shell shall be five inches and maximum length of shell 21 inches.

(d) Service pressure[1]. Must be 240 pounds per square inch.

3. Inspection by whom and where. (a) By competent and independent inspector approved by the Canadian Transport Commission.

(b) Except as provided in paragraph (c) of this section, for cylinders not made in Canada the tests, as specified, shall be made within the limits of Canada unless written permission is obtained from the Commission to conduct the tests elsewhere.

(c) Notwithstanding paragraph (b) of this section cylinders made within the United States of America shall not be transported by rail in Canada unless they have been fabricated and tested in complete accordance with the applicable CTC or DOT Specification under the supervision of a representative from an independent inspection agency approved by the Commission.

4. Duties of inspector. Inspector shall: (a) Inspect all material and reject any not complying with requirements.

(b) Verify chemical analysis of each heat of material by analysis or by obtaining certified analysis: Provided, That a certificate from the manufacturer thereof, giving sufficient data to indicate compliance with requirements, is acceptable when verified by check analyses of samples taken from one cylinder out of each lot of 200 or less.

(c) Verify compliance of cylinders with all requirements including markings; inspect inside before closing in both ends; verify heat treatment as proper; obtain samples for all tests and check chemical analyses; witness all tests; verify threads by gauge; report volumetric capacity and tare weight (see report form) and minimum thickness of wall noted.

(d) Render complete report required by this specification to cylinder maker, Canadian Transport Commission and upon request to the purchaser.

5. Steel. (a) Open-hearth, basic oxygen or electric steel of uniform quality. Plain carbon steel content per cent for the following not over: Carbon, 0.25; phosphorus, 0.045; sulphur, 0.050. The addition of other elements for alloying effect is prohibited.

6. Identification of material. (a) Required; any suitable method.

7. Defects. (a) Material with seams, cracks, laminations, or other injurious defects, not authorized.

8. Manufacture. (a) By best appliances and methods; dirt and scale to be removed as necessary to afford proper inspection; no defect acceptable that is likely to weaken the finished cylinder appreciably; reasonably smooth and uniform surface finish required. Heads may be attached to shells by lap brazing or may be formed integrally. The thickness of the bottom of cylinders welded or formed by spinning is, under no condition, to be less than two times the minimum wall thickness of the cylindrical shell; such bottom thicknesses to be measured within an area bounded by a line representing the points of contact between the cylinder and floor when the cylinder is in a vertical position. Seams must be made as follows:

(b) Circumferential seams, By brazing only. Heads attached to shells by the lap brazing method shall overlap not less than four times wall thickness. Brazing material shall have a melting point of not less than 1000°F. Heads must have a driving fit with the shell unless the shell is crimped, swedged, or curled over the skirt or flange of the head and be thoroughly brazed until complete penetration of the joint by the brazing material is secured. Brazed joints may be repaired by brazing.

[1] The "service pressure" limits the use of the cylinder. It is shown by marks on cylinder for example, CTC-4B240ET indicates the service pressure as 240 pounds per square inch.

(c) Longitudinal seams in shell: Electric resistance welded joints only. No repairs to longitudinal joints permitted.

9. Welding or brazing. (a) The attachment to the tops and bottoms only of cylinders by welding or brazing of neckrings, footrings, handles, bosses, pads, and valve protection rings is authorized provided that such attachments and the portion of the container to which they are attached are made of weldable steel, the carbon content of which must not exceed 0.25 per cent.

10. Wall thickness. (a) The wall stress at two times service pressure shall not exceed 18,000 pounds per square inch. Minimum thickness shall be 0.044 inch.

(b) Calculation must be made by the formula:

$$S = \frac{P\,(1.3D^2 + 0.4d^2)}{D^2 - d^2}$$

where:

S = wall stress in pounds per square inch;
P = 2 times service pressure;
D = outside diameter in inches;
d = inside diameter in inches.

11. Heat treatment. (a) Heads formed by drawing or pressing must be uniformly and properly heat treated prior to tests.

(b) Cylinders with integral formed heads or bases must be subjected to a normalizing operation. Normalizing and brazing operations may be combined, provided the operation is carried out at a temperature in excess of the upper critical temperature of the steel.

12. Openings in cylinders. (a) Each opening in cylinders, except those for safety devices, must be provided with a fitting, boss, or pad, securely attached to cylinder by brazing or by welding or by threads. Fitting, boss, or pad must be of steel suitable for the method of attachment employed, and which need not be identified or verified as to analysis, except that if attachment is by welding, carbon content must not exceed 0.25 per cent. If threads are used, they must comply with the following:

(1) Threads must be clean cut, even, without checks, and tapped to gauge.

(2) Taper threads to be of length not less than as specified for American Standard taper pipe threads.

(3) Straight threads, having at least 4 engaged threads, to have tight fit and calculated shear strength at least 10 times the test pressure of the cylinder; gaskets required, adequate to prevent leakage.

(b) Closure of fitting, boss, or pad must be adequate to prevent leakage.

13. Safety devices and protection for valves, safety devices, and other connections, if applied. (a) Devices must be as required by the Canadian Transport Commission regulations that apply (see §§ 73.34 (d) and 73.301 (g)).

14. Hydrostatic test. (a) By water-jacket, or other suitable method, operated so as to obtain accurate data. Pressure gauge must permit reading to accuracy of 1 per cent. Expansion gauge must permit reading of total expansion to accuracy either of 1 per cent or 0.1 cubic centimetre.

(b) Pressure must be maintained for 30 seconds and sufficiently longer to insure complete expansion. Any internal pressure applied after heat-treatment and previous to the official test must not exceed 90 per cent of the test pressure. If, due to failure of the test apparatus, the test pressure cannot be maintained, the test may be repeated at a pressure increased by 10 per cent or 100 pounds per square inch, whichever is the lower.

(c) Permanent volumetric expansion must not exceed 10 per cent of total volumetric expansion at test pressure.

(d) Cylinders must be tested as follows:

(1) At least one cylinder selected at random out of each lot of 200 or less shall be tested as outlined in paragraphs (a), (b), and (c) of this section to at least two times service pressure.

(2) All cylinders not tested as outlined in subparagraph (d) (1) of this section must be examined under pressure of at least two times service pressure and show no defect.

(e) Each 1000 cylinders or less successively produced each day shall constitute a lot. One cylinder shall be selected from each lot and hydrostatically tested to destruction. If this cylinder bursts below five times the service pressure, then two additional cylinders must be selected and subjected to this test. If either of these cylinders fails by bursting below five times the service pressure, then the entire lot must be rejected. All cylinders constituting a lot shall be of identical size, construction, heat-treatment, finish, and quality.

15. Flattening test. (a) Between knife edges, wedge shaped, 60° angle, rounded to ½″ radius; test 1 cylinder taken at random out of each lot of 200 or less, after hydrostatic test.

16. Physical test. (a) To determine yield strength, tensile strength, elongation, and reduction of area of material. Required on 2 specimens cut from 1 cylinder, or part thereof heat-treated as required, taken at random out of each lot of 200 or less in the case of cylinders of capacity greater than 86 cubic inches and out of each lot of 500 or less for cylinders having a capacity of 86 cubic inches or less.

(b) Specimens must be: Gauge length 8 inches with width not over 1½ inches; or, gauge length 2 inches with width not over 1½ inches; provided, that gauge length at least 24 times thickness with width not over 6 times thickness is authorized when cylinder wall is not over 3/16 inch thick. The specimen, exclusive of grip ends, must not be flattened. Grip ends may be flattened to within one inch of each end of the reduced section. When size of cylinder does not permit securing straight specimens, the specimens may be taken in any location or direction and may be straightened or flattened cold, by pressure only, not by blows; when specimens are so taken and prepared, the inspector's report must show in connection with record of physical tests detailed information in regard to such specimens. Heating of specimen for any purpose is not authorized.

(c) The yield strength in tension shall be the stress corresponding to a permanent strain of 0.2 per cent of the gauge length.

(1) The yield strength shall be determined by either the "offset" method or the "extension under load" method as prescribed in ASTM Standard E8-57T.

(2) In using the "extension under load" method, the total strain (or "extension under load") corresponding to the stress at which the 0.2 per cent permanent strain occurs may be determined with sufficient accuracy by calculating the elastic extension of the gauge length under appropriate load and adding thereto 0.2 per cent of the gauge length. Elastic extension calculations shall be based on an elastic modulus of 30,000,000. In the event of controversy, the entire stress-strain diagram shall be plotted and the yield strength determined from the 0.2 per cent offset.

(3) For the purpose of strain measurement, the initial strain shall be set while the specimen is under a stress of 12,000 pounds per square inch, the strain indicator reading being set at the calculated corresponding strain.

(4) Cross-head speed of the testing machine shall not exceed ⅛ inch per minute during yield strength determination.

17. Acceptable results for physical and flattening tests. (a) Elongation at least 40 per cent for 2 inch gauge length or at least 20 per cent in other cases; yield strength not over 73 per cent of tensile strength; flattening test required, without cracking, to six times wall thickness with weld 90° from direction of applied load. Two rings cut from the ends of length of pipe used in production of a lot may be used for flattening test provided the rings accompany the lot which they represent in all thermal processing operations. At least one of the rings must pass the flattening test.

18. Leakage test. (a) All spun cylinders and plugged cylinders (see Notes 1 and 2) must be tested for leakage by gas or air pressure after the bottom has been cleaned and is free from all moisture. Pressure, approximately the same as but no less than service pressure, must be applied to one side of the finished bottom over an area of at least 1/16 of the total area of the bottom but not less than ¾″ in diameter, including the closure, for at least 1 minute, during which time the other side of the bottom exposed to pressure must be covered with water and closely examined for indications of leakage. Leakers must be rejected (See sec. 19(a)(1).)

NOTE 1: A spun cylinder is one in which an end closure in the finished cylinder has been welded by the spinning process.

NOTE 2: A plugged cylinder is one in which a permanent closure in the bottom of a finished cylinder has been effected by a plug.

NOTE 3: As a safety precaution, if the manufacturer elects to make this test before the hydrostatic test, he should design his apparatus so that the pressure is applied to the smallest area practicable, around the point of closure, and so as to use the smallest possible volume of air or gas.

19. Rejected cylinders. (a) Repairs authorized. Leakers must be rejected, except that:

(1) Spun cylinders rejected under the provisions of sec. 18 may be removed from the spun cylinder category by drilling to remove defective material, tapping, and plugging.

(2) Brazed joints may be rebrazed.

(3) Subsequent to the operations noted above in subparagraphs (1) and (2) of this paragraph, acceptable cylinders must pass all prescribed tests.

20. Marking. (a) Marking on each cylinder by stamping plainly and permanently on shoulder, top head, neck or valve protection collar which is permanently attached to the cylinders and forming an integral part thereof, provided that cylinders not less than 0.090 inches thick may be stamped on the side wall adjacent to top head, as follows:

(1) CTC-4B240ET.

(2) A serial[1] number and an identifying symbol (letters); location[2] of number to be just below or immediately following the CTC mark; location[2] of symbol to be just below or immediately following the number. The symbol and numbers must be those of purchaser, user, or maker. The symbol must be registered with the Bureau of Explosives through the Canadian Transport Commission, duplications unauthorized.

Examples:	CTC-4 B240ET 1234 XY	CTC-4 B240ET-1234-XY

(3) Inspector's official mark, near serial number; date of test (such as 5-50 for May 1950), so placed that date of subsequent test can be easily added; and word "SPUN" or "PLUG" near CTC mark when an end closure in the finished cylinder has been welded by the spinning process or effected by plugging.

21. Size of marks. (a) At least ¼″ high if space permits.

22. Inspector's report. (a) Required to be clear, legible, and in following form:

(Place) .....
(Date) .....

Gas Cylinders

Manufactured for ..... Company
Location at .....
Manufactured by ..... Company
Location at .....
Consigned to ..... Company
Location at .....
Quantity .....
Size ..... inches outside diameter by ..... inches long
Marks stamped into the shoulder of the cylinder are:
Specification CTC .....
Serial numbers . to ..... inclusive
Inspector's mark .....
Identifying symbol (registered) .....
Test date .....
Tare weights (yes or no) .....
Other marks (if any) .....
These cylinders were made by process of .....
.....
.....
The ..... permitted
(neckrings, footrings, etc.)
in sec. 9 were attached by process of .....
.....
(welding brasing)

[1] Lot numbers, not over 500 cylinders in each lot, authorized for cylinders not over 2 inches outside diameter and for cylinders over 2 inches outside diameter when the volumetric capacity does not exceed 170 cubic inches.

[2] Symbol in front of or following the number with ample space between or symbol and serial number stamped into welded or brazed-on valve spud directly above the CTC specification mark located on head of cylinder are also authorized. Other variations in location authorized only when necessitated by lack of space.

The material used was identified by the following ..... numbers
(heat-purchase order)

.....

The material used was verified as to chemical analysis and record thereof is attached hereto. The heat numbers .....
(were were not)
marked on the material.

All material, such as plates, billets and electric resistance welded tubing, was inspected and each cylinder was inspected both before and after closing in the ends; all that was accepted was found free from seams, cracks, laminations, and other defects which might prove injurious to the strength of the cylinder. The processes of manufacture and heat treatment of cylinders were supervised and found to be efficient and satisfactory.

The cylinder walls were measured and the minimum thickness noted was ..... inch. The outside diameter was determined by a close approximation to be ..... inches. The wall stress was calculated to be ..... pounds per square inch under an internal pressure of ..... pounds per square inch.

Hydrostatic tests, flattening tests, tensile tests of material, and other tests, as prescribed in specification No. CTC-4B240ET were made in the presence of the inspector and all material and cylinders accepted were found to be in compliance with the requirements of that specification. Records thereof are attached hereto.

A certificate of test on the electric resistance tubing has been obtained from the tubing manufacturer. Records thereof are attached hereto.

I hereby certify that all of these cylinders proved satisfactory in every way and comply with the requirements of the Canadian Transport Commission specification No. CTC-4B240ET except as follows:

Exceptions .....

.....

(Signed) .....
Inspector

Specification 4BW

WELDED STEEL CYLINDERS MADE OF DEFINITELY PRESCRIBED STEELS WITH ELECTRIC-ARC WELDED LONGITUDINAL SEAM

1. Compliance. (a) Required in all details.

2. Type, size and service pressure. (a) Must be welded type with longitudinal electric-arc welded seam, not over 1000 pounds water capacity (nominal); service pressure at least 225 and not over 500 pounds per square inch gauge. Cylinders closed in by spinning process not authorized.

3. Inspection by whom and where. (a) By competent and independent inspector approved by the Canadian Transport Commission.

(b) Except as provided in paragraph (c) of this section, for cylinders not made in Canada the tests, as specified, shall be made within the limits of Canada unless written permission is obtained from the Commission to conduct the tests elsewhere.

(c) Notwithstanding paragraph (b) of this section cylinders made within the United States of America shall not be transported by rail in Canada unless they have been fabricated and tested in complete accordance with the applicable CTC or DOT Specification under the supervision of a representative from an independent inspection agency approved by the Commission.

4. Duties of inspector. (a) Inspect all material and reject any not complying with requirements of this specification.

(b) Verify chemical analysis of each heat of material by analysis or by obtaining certified analysis; provided, that a certificate from the manufacturer thereof, giving sufficient data to indicate compliance with requirements is acceptable when verified by check analyses of samples taken from one cylinder out of each lot of 200 or less.

(c) Verify compliance of cylinders with specification requirements including: markings; condition of inside; tests; threads; heat treatment. Obtain samples for all tests, and check chemical analyses, witness all tests; report volumetric capacity, tare weight (see report form), and minimum thickness of wall noted.

(d) Render complete report required by this specification to cylinder maker, Canadian Transport Commission and upon request to the purchaser.

5. Authorized steel. (a) As specified in Table I of Appendix A.

(b) Heads. Material for heads shall be the same as paragraph (a) of this section or shall be open hearth, electric or basic oxygen carbon steel of uniform quality. Content per cent for the following not over: Carbon, 0.25; manganese, 0.60; phosphorus, .045; sulphur, .050.

(1) Heads shall be hemispherical or elipsoidal in shape with a maximum ratio of 2:1. If low carbon steel is used thickness of such heads shall be determined by using a maximum wall stress of 24,000 psi in formula shown in 10(a) of this specification.

6. Identification of material. (a) Required; any suitable method.

7. Defects. (a) Material with seams, cracks, laminations or other injurious defects, not authorized.

8. Manufacture. (a) By suitable appliances and methods; dirt and scale to be removed as necessary to afford proper inspection; no defect acceptable that is likely to weaken the finished cylinder appreciably; reasonably smooth and uniform surface required. Exposed bottom welds on cylinders over 18 inches long must be protected by footrings. Minimum thickness of heads shall be not less than 90 per cent of the required thickness of the sidewall. Heads shall be concave to pressure.

(b) Circumferential seams. By electric-arc welding. Joints shall be butt with one member offset (joggle butt) or lap with minimum overlap of at least four times nominal sheet thickness.

(c) Longitudinal seams in shells.

(1) Longitudinal electric-arc welded seams shall be of the butt-welded type. Welds must be made by a machine process including automatic feed and welding guidance mechanisms. Longitudinal seams shall have complete joint penetration, and shall be free from undercuts, overlaps or abrupt ridges or valleys. Misalignment of mating butt edges shall not exceed 1/6 of nominal sheet thickness or 1/32 inch whichever is less. All joints with nominal sheet thickness up to and including ⅛ inch shall be tightly butted. When nominal sheet thickness is greater than ⅛ inch, the joint shall be

gapped for maximum distance equal to one-half the nominal sheet thickness or 1/32 inch whichever is less. Joint design, preparation and fit-up shall be such that requirements of 8 (d) are satisfied.

(2) Maximum joint efficiency shall be 1.0 when each seam is radiographed completely. Maximum joint efficiency shall be 0.90 when one cylinder from each lot of 50 consecutively welded cylinders is spot radiographed. In addition, one out of the first five cylinders welded following a shut down of welding operations exceeding four hours shall be spot radiographed. Spot radiographs, when required, shall be made of a finished welded cylinder and shall include the girth weld for 2 inches in both directions from the intersection of the longitudinal and girth welds and include at least 6 inches of the longitudinal weld. **Maximum** joint efficiency of 0.75 shall be permissible without radiography.

(d) Welding procedure and operators must be qualified in accordance with the sections that apply in CGA Pamphlet C-3.

9. Welding of attachments. (a) The attachment to the tops and bottoms only of cylinders by welding of neckrings, footrings, handles, bosses, pads and valve protection rings is authorized provided that such attachments and the portion of the container to which they are attached are made of weldable steel, the carbon content of which must not exceed 0.25 per cent.

10. Wall thickness.[1] (a) For outside diameters over 6 inches the minimum wall thickness shall be 0.078 inch. In any case the minimum wall thickness shall be such that the wall stress calculated by the formula (see Note 1):

$$S = \frac{2P\,(1.3D^2 + 0.4d^2)}{E\,(D^2 - d^2)}$$

shall not exceed the lesser value of any of the following:

(1) The value shown in Table I, 5(a) for the particular material under consideration.

(2) One-half the minimum tensile strength of the material determined as required in 15.

(3) 35,000 pounds per square inch.

NOTE 1: In the formula above quoted.
S = wall stress, psi;
P = service pressure, psi;
D = outside diameter, inches;
d = inside diameter, inches;
E = joint efficiency of the longitudinal seam (from 8(c) (2).

(b) In any cylinder with wall thickness less than 0.100 inch, the ratio of tangential length to outside diameter shall not exceed 4.0.

11. Heat treatment. (a) Each cylinder must be uniformly and properly heat treated prior to test by the applicable method shown in 5(a), Table I. Heat treatment must be accomplished after all forming and welding operations.

(b) Heat treatment is not required after welding or brazing weldable low carbon parts to attachments of similar material which have been previously welded to the top or bottom of cylinders and properly heat treated, provided such subsequent welding or brazing does not produce a temperature in excess of 400°F. in any part of the top or bottom material.

12. Openings in cylinders. (a) All openings must be in the heads or bases.

(b) Openings in cylinders must be provided with adequate fittings, bosses, or pads, integral with or securely attached to the cylinder by welding.

(c) Threads must comply with the following:

(1) Threads must be clean cut and to gauge.

(2) Taper threads must be of length not less than as specified for American Standard Taper Pipe threads.

(3) Straight threads, having at least 4 engaged threads, to have tight fit and calculated shear strength at least 10 times the test pressure of the cylinder; gaskets required, adequate to prevent leakage.

(d) Closure of fittings, boss or pads must be adequate to prevent leakage.

13. Safety relief devices and protection for valves, safety devices and other connections, if applied. (a) Must be as required by the Canadian Transport Commission's Regulations that apply. (See §§ 73.34(d) and 73.301(g) of this chapter.)

14. Hydrostatic test. (a) By water jacket, or other suitable method, operated so as to obtain accurate data. Pressure gauge must permit readings to accuracy of one per cent. Expansion gauge must permit readings of total volumetric expansion to accuracy either of one per cent or 0.1 cubic centimetre.

(b) Pressure must be maintained for 30 seconds and sufficiently longer to insure complete expansion. Any internal pressure applied after heat treatment and previous to the official test must not exceed 90 per cent of the test pressure.

(c) Permanent volumetric expansion must not exceed 10 per cent of the total volumetric expansion at test pressure.

(d) Cylinders must be tested as follows:

(1) At least one cylinder selected at random out of each lot of 200 or less shall be tested as outlined in paragraphs (a), (b) and (c) of this section to at least two times service pressure.

(2) All cylinders not tested as outlined in subparagraph (d) (1) of this section must be examined under pressure of at least two times service pressure and show no defect.

(e) One finished cylinder selected at random out of each lot of 500 or less successively produced shall be hydrostatically tested to 4 times service pressure without bursting.

15. Physical test. (a) to determine yield strength, tensile strength and elongation of material. Required on a specimen cut from each head and body section of a cylinder having passed the hydrostatic test.

(b) Specimens must be: Gauge length 8 inches with width not over 1½ inches; or, gauge length 2 inches with width not over 1½ inches, provided that gauge length at least 24 times thickness with width not over 6 times

thickness is authorized when cylinder wall is not over 3/16 inch thick. The specimen, exclusive of grip ends, must not be flattened. Grip ends may be flattened to within one inch of each end of the reduced section. When size of cylinder does not permit securing straight specimens, the specimens may be taken in any location or direction and may be straightened or flattened cold, by pressure only, not by blows; when specimens are so taken and prepared, the inspector's report must show in connection with record of physical tests detailed information in regard to such specimens. Heating of specimens for any purpose is not authorized.

(c) The yield strength in tension shall be the stress corresponding to a permanent strain of 0.2 per cent of the gauge length.

(1) The yield strength shall be determined by either the "offset" method or the "extension under load" method as prescribed in ASTM Standard E8-57T.

(2) In using the "extension under load" method, the total strain (or "extension under load"), corresponding to the stress at which the 0.2 per cent permanent strain occurs may be determined with sufficient accuracy by calculating the elastic extension of the gauge length under appropriate load and adding thereto 0.2 per cent of the gauge length. Elastic extension calculations shall be based on an elastic modulus of 30,000,000. In the event of controversy, the entire stress strain diagram shall be plotted and the yield strength determined from the 0.2 per cent offset.

(3) For the purpose of strain measurement, the initial strain reference shall be set while the specimen is under a stress of 12,000 pounds per square inch, the strain indicator reading being set at the calculated corresponding strain.

(4) Cross-head speed of the testing machine shall not exceed ⅛ inch per minute during yield strength determination.

16. Elongation. (a) Physical test specimens must show at least 40 per cent for 2-inch gauge length or at least 20 per cent in other cases, except that these elongation percentages may be reduced numerically by 2 for 2 inch specimens and by one in other cases for each 7,500 pounds per square inch increment of tensile strength above 50,000 pounds per square inch to a maximum of four increments.

17. Tests of welds. (a) Tensile test. A specimen shall be cut from one cylinder of each lot of 200 or less. The specimen shall be taken across the longitudinal seam and shall be prepared and tested in accordance with and must meet the requirements of CGA Pamphlet C-3. Failure must occur in the parent metal.

(b) Guided bend test. A "root" test specimen shall be cut from the cylinder used for the tensile test specified in 17(a). Specimens shall be taken across the longitudinal seam and shall be prepared and tested in accordance with and shall meet the requirements of CGA Pamphlet C-3.

(c) Alternate guided bend test. This test may be used and shall be as required by CGA Pamphlet C-3. The specimen shall be bent until the elongation at the outer surface, adjacent to the root of the weld, between the lightly scribed gauge lines a to b, shall be at least 20 per cent, except that this percentage may be reduced for steels having a tensile strength in excess of 50,000 pounds per square inch, as provided in 16(a).

18. Radiographic examination. (a) Radiographic inspection shall conform to the techniques and acceptability criteria set forth in CGA Pamphlet C-3.

(b) Should spot radiographic examination fail to meet the requirements of paragraph (a) of this section, two additional welds from the same lot of 50 cylinders or less shall be examined, and if either of these fail to meet the requirements, each cylinder shall be examined as previously outlined, only those passing are acceptable.

19. Rejected cylinders. (a) Unless otherwise stated, if a sample cylinder or specimen taken from a lot of cylinders fails the prescribed test, then two additional specimens must be selected from the same lot and subjected to the prescribed test. If either of these fail the test then the entire lot must be rejected.

(b) Reheat treatment authorized; subsequent thereto, acceptable cylinders must pass all prescribed tests. Repair of welded seams by welding is authorized provided that all defective metal be cut away and joint be rewelded as prescribed for original welded joints.

20. Marking. (a) Marking on each cylinder stamped as follows:

(1) CTC-4BW followed by the service pressure (for example, CTC-4BW240, etc.).

(2) A serial number and an identifying symbol, both to be of the purchaser, user, or maker. The symbol must be registered with the Bureau of Explosives through the Commission. Duplications unauthorized.

(3) Inspector's official mark.

(4) Date of test (for example, 12-64, for December 1964).

(5) Additional markings are permitted.

(b) Sequence of marks. CTC specification designation, registered symbol and serial number shall be in close proximity. Inspector's official mark shall be near the serial number. Date of test shall be so placed that dates of subsequent test can easily be added.

(c) Location of markings. Markings may be stamped plainly and permanently in the following locations on the cylinder:

(1) On shoulders and top heads not less than 0.087 inch thick.

(2) On neck, valve boss, valve protection sleeve, or similar part permanently attached to top end of cylinder.

(3) On a plate attached to the top of the cylinder or permanent part thereof; sufficient space must be left on the plate to provide for stamping at least six retest dates; the plate must be at least 1/16 inch thick and must be attached by welding, or by brazing at a temperature of at least 1100°F. throughout all edges of the plate.

(4) Variations in location of markings when necessitated by lack of space permissible only when authorized by the Commission.

(d) Size of marks. Space permitting, at least ¼ inch high.

21. Inspector's report. (a) Required to be clear, legible and in following form:

(Place) .....
(Date)

Steel Gas Cylinders
Manufactured for ..... Company
Location at .....
Manufactured by ..... Company
Location at .....
Consigned to ..... Company
Location at .....
Quantity .....
Size ..... inches outside diameter by ..... inches long.
Marks stamped into the
of the cylinder are: (location of marking)
Specification CTC
Serial numbers ..... to .. inclusive
Inspector's mark .....
Identifying symbol (registered)
Test date .....
Tare weights (yes or no) ..
Other marks

These cylinders were made by process of

The material used was type ..... authorized in Table I of Spec. 4BW.
The material used was identified by the following ..... (heat-purchase order) numbers .....

The material used was verified as to chemical analysis and record thereof is attached hereto. The heat numbers ..... marked on the material. (were-were not)

All material was inspected and all that was accepted was found free from seams, cracks, laminations and other injurious defects.

Radiography ..... (type and amount)

The compliance of cylinders with specification requirements was verified including markings, condition of inside, tests, threads, etc. All cylinders with defects which might prove injurious were rejected. The processes of manufacture and heat treatment were supervised and found to be efficient and satisfactory.

The cylinder walls were measured and the minimum thickness noted was ... inch. The outside diameter was determined to be ..... inches. The wall stress was calculated to be ..... pounds per square inch.

Hydrostatic tests, tensile tests of material, and other tests as prescribed in specification No. 4BW..... were made in the presence of the inspector and all cylinders accepted were found to be in compliance with the requirements of that specification. Records thereof are attached hereto.

Each cylinder..... been equipped with safety devices as follows: (has-has not)

I hereby certify that all of these cylinders proved satisfactory in every way and comply with the requirements of Canadian Transport Commission specification No. 4BW except as follows:

Exceptions .....

(Manufacturer's name)
(Signed)
Inspector
(By)
(Place)
(Date)

RECORD OF CHEMICAL ANALYSIS OF STEEL FOR CYLINDERS

Numbers ..... to ..... inclusive
Size ..... inches outside diameter by ..... inches long.
Made by ..... Company
For ..... Company

Test No.	Heat No.	Check analysis No.	Cylinders represented (serial Nos.)	Chemical analysis										
				C	P	S	Si	Mn	Ni	Cr	Mo	Cu	Al	Zr

Steel was manufactured by ..... Company.

The original of the certified mill test reports are in files of the manufacturer.

NOTE: Any omission of analyses by heats, if authorized, must be accounted for by notation hereon reading "The prescribed certificate of the manufacturer of material has been secured, found satisfactory, and placed on file," or by attaching a copy of the certificate.

Chemical analyses were made by .....
(Place)
(Date)

RECORD OF PHYSICAL TESTS OF MATERIAL FOR CYLINDERS

Numbered ..... to ..... inclusive
Size ..... inches outside diameter by ..... inches long.
Made by ..... Company
For ..... Company

Test No.	Cylinders represented by test (Serial Nos.)	Yield strength (pounds per sq. inch)	Tensile strength (pounds per sq. inch)	Elongation (per cent) in inches)	Reduction of area (per cent)	Weld tensile test	Weld bend test

(Signed) .....
(Place) .....
(Date) .....

RECORD OF HYDROSTATIC TESTS ON CYLINDERS

Numbered ..... to ..... inclusive
Size ..... inches outside diameter by ..... inches long.
Made by ..... Company
For ..... Company

Serial numbers of cylinders tested arranged numerically	Actual test pressure (pounds per sq. inch)	Total expansion (cubic centimeters)[1]	Permanent expansion (cubic centimetres)[1]	Percent ratio of permanent expansion to total expansion[1]	Burst test (pounds per sq inch)	Tare weight (pounds)[2]	Volumetric capacity[3]

NOTE 1: When specifications require test for only one out of each lot of 200 or less cylinders, the check on the others must be indicated by a notation hereon reading. "Each cylinder was subjected to a pressure of ..... pounds per square inch and showed no defect."

[1] If the tests are made by a method involving the measurement of the amount of liquid forced into the cylinder by the test pressure, then the basic data, on which the calculations are made, such as the pump factors, temperature of liquid, coefficient of compressibility of liquid, etc., must also be given.

[2] Do not include removable cap but state whether with or without valve. These weights must be accurate to a tolerance of one per cent.

[3] Report approximate maximum and minimum volumetric capacity for the lot.

(Signed)

(Place)
(Date)

RECORD OF CHEMICAL ANALYSIS OF MATERIAL FOR CYLINDERS

Numbered ..... to ..... inclusive.
Size ..... inches outside diameter by ..... inches long.
Made by ..... Company
For ..... Company

NOTE: Any omission of analyses by heats, if authorized, must be accounted for by notation hereon reading, "The prescribed certificate of the manufacturer of material has been secured, found satisfactory, and placed on file," or by attaching a copy of the certificate.

Test No.	Heat No.	Check analysis No.	Cylinders represented (serial Nos.)	Chemical analysis						
				C	P	S	Si	Mn	Ni	Cr

The analyses were made by

(Signed)
(Place)
(Date)

RECORD OF PHYSICAL TESTS OF MATERIAL FOR CYLINDERS

Numbered ..... to ..... inclusive.
Size ..... inches outside diameter by ..... inches long.
Made by ..... Company
For ..... Company

Test No.	Cylinders represented by test (Serial Nos.)	Yield strength (pounds per square inch)	Tensile strength (pounds per square inch)	Elongation (per cent in 8 inches)	Reduction of area (per cent)	Flattening test	Bursting test (pounds per square inch)

(Place)
(Date)

RECORD OF HYDROSTATIC TESTS ON CYLINDERS

Numbered ..... to ..... inclusive.
Size ..... inches outside diameter by ..... inches long.
Made by ..... Company
For ..... Company

Serial numbers of cylinders tested arranged numerically	Actual test pressure (pounds per square inch)	Total expansion (cubic centimetres)[1]	Permanent expansion (cubic centimetres)[1]	Per cent ratio of permanent expansion to total expansion[1]	Tare weight (pounds)[2]	Volumetric capacity[3]

NOTE: When specifications require test for only 1 out of each lot of 200 or less cylinders, the check on the others must be indicated by a notation hereon reading. "Each cylinder was subjected to a pressure of ..... pounds per square inch and showed no defect."

[1] If the tests are made by a method involving the measurement of the amount of liquid forced into the cylinder by the test pressure, then the basic data, on which the calculations are made, such as the pump factors, temperature of liquid, coefficient of compressibility of liquid, etc., must also be given.

[2] Do not include removable cap but state whether with or without valve. These weights must be accurate to a tolerance of 1 per cent.

[3] Report approximate maximum and minimum volumetric capacity for the lot.

(Signed)

Specification 4D

INSIDE CONTAINERS

WELDED STEEL

for aircraft use

1. Compliance. (a) Required in all details.

2. Type, size, and service pressure. (a) Type and size. Welded steel spheres (two seamless hemispheres) or circumferentially welded cylinders (two seamless drawn shells) not over 1100 cubic inches capacity. Cylinders closed in by spinning process not authorized.

(b) Service pressure.[4] At least 300 to not over 500 pounds per square inch.

3. Inspection by whom and where. (a) By competent and independent inspector approved by the Canadian Transport Commission.

(b) Except as provided in paragraph (c) of this section, for cylinders not made in Canada the tests, as specified, shall be made within the limits of Canada unless written permission is obtained from the Commission to conduct the tests elsewhere.

(c) Notwithstanding paragraph (b) of this section cylinders made within the United States of America shall not be transported by rail in Canada unless they have been fabricated and tested in complete accordance with the applicable CTC or DOT Specification under the supervision of a representative from an independent inspection agency approved by the Commission.

4. Duties of inspector. (a) Inspect all material and reject any not complying with requirements; for cylinders made by billet-piercing process, billets to be inspected after nick and cold break.

(b) Verify chemical analysis of each heat of material by analysis or by obtaining certified analysis: **Provided,** That a certificate from the manufacturer thereof, giving sufficient data to indicate compliance with requirements, is acceptable when verified by check analyses of samples taken from one cylinder out of each lot of 200 or less.

(c) Verify compliance of cylinders with all requirements including markings; inspect inside before closing in both ends; verify heat treatment as proper; obtain samples for all tests and check chemical analyses; witness all tests; verify threads by gauge; report volumetric capacity and tare weight (see report form) and minimum thickness of wall noted.

(d) Render complete report required by this specification to cylinder maker, Canadian Transport Commission and upon request to the purchaser.

5. Steel. (a) Open-hearth or electric steel of uniform and weldable quality. Content per cent for the following not over: Carbon, 0.25; phosphorus, 0.045; sulphur, 0.050, except that the following steels commercially known as 4130X, Type 304, 316, 321, and 347 stainless steels may be used with proper welding procedure and complying with the following analyses:

[4] The "service pressure" limits the use of the container. It is shown by marks on container; for example, CTC-4D300 indicates the service pressure as 300 pounds per square inch.

4130X

	Per cent
Carbon	0.25 0.35
Manganese	0.40 0.60
Phosphorus	0.04 max.
Sulphur	0.05 max.
Silicon	0.20 0.35
Chromium	0.80 1.10
Molybdenum	0.15 0.25
Zirconium	
Nickel	

	Stainless steels			
	304 (per cent)	316 (per cent)	321 (per cent)	347 (per cent)
Carbon (max.)	0.08	0.08	0.08	0.08
Manganese (max.)	2.00	2.00	2.00	2.00
Phosphorus (max.)	.030	.045	.030	.030
Sulphur (max.)	.030	.030	.030	.030
Silicon (max.)	75	1.00	75	75
Nickel	8.0 11.0	10.0 14.0	9.0 13.0	9.0 13.0
Chromium	18.0 20.0	16.0 18.0	17.0 20.0	17.0 20.0
Molybdenum		2.0 3.0		
Titanium			[1]	
Columbium				[2]

[1] Titanium shall be not less than 5 × C and not more than 0.60 per cent.
[2] Columbium shall be not less than 10 × C and not more than 1.0 per cent.

Note 1: A heat of steel made under the above specifications, check chemical analysis of which is slightly out of the specified range, is acceptable, if satisfactory in all other respects, provided the tolerance shown in the following table are not exceeded except as approved by the Commission or the Bureau of Explosives:

CHECK ANALYSIS TOLERANCES

Element	Limit or maximum specified (per cent)	Tolerance (per cent) over the maximum limit or under the minimum limit: Under minimum limit	Over maximum limit
Carbon	To 0.15 incl.	0.01	0.01
	Over 0.15 to 0.40 incl.	0.03	0.04
Manganese	To 0.60 incl.	0.03	0.03
	Over 1.15 to 2.50 incl.	0.05	0.05
Phosphorus[1]	All ranges		0.01
Sulphur	All ranges		0.01
Silicon	To 0.30 incl.	0.02	0.03
	Over 0.30 to 1.00 incl.	0.05	0.05
Nickel	Over 5.30 to 10.00 incl.	0.10	0.10
	Over 10.00 to 14.00 incl.	0.15	0.15
Chromium	To 0.90 incl.	0.03	0.03
	Over 0.90 to 2.10 incl.	0.05	0.05
	Over 15.00 to 20.00 incl.	0.20	0.20
Molybdenum	To 0.20 incl.	0.01	0.01
	Over 0.20 to 0.40 incl.	0.02	0.02
	Over 1.75 to 3.00 incl.	0.10	0.10
Titanium	All ranges	0.05	0.05
Columbium	All ranges	0.05	0.05

[1] Rephosphorized steels not subject to check analysis for phosphorus.

6. Identification of material. (a) Required; any suitable method except that plates and billets for hot-drawn cylinders shall be marked with heat number.

7. Defects. (a) Material with seams, cracks, laminations, or other injurious defects, not authorized.

8. Manufacture. (a) By best appliances and methods; dirt and scale to be removed as necessary to afford proper inspection; no defect acceptable that is likely to weaken the finished container appreciably; reasonably smooth and uniform surface finish required.

9. Wall thickness. (a) The wall stress at minimum test pressure shall not exceed 24,000 pounds per square inch, except where steels commercially known as 4130X, Type 304, 316, 321 and 347 stainless steels are used, stress at test pressure shall not exceed 37,000 pounds per square inch. Minimum wall 0.040 inch for any diameter container.

(b) Calculation for a sphere must be made by the formula:

$$S = \frac{PD}{4tE}$$

where:

S = wall stress in pounds per square inch;
P = test pressure prescribed for water-jacket test, i.e., at least two times service pressure, in pounds per square inch;
D = outside diameter in inches;
t = minimum wall thickness in inches;
⑨ E = 0.85 (provides 85 per cent weld efficiency factor which must be applied in the girth weld area and heat affected zones which zone shall extend a distance of 6 times wall thickness from centre line of weld);
E = 1.0 (for all other areas).

(c) Calculation for a cylinder must be made by the formula:

$$S = \frac{P\,(1.3D^2 + 0.4d^2)}{D^2 - d^2}$$

where:

S = wall stress in pounds per square inch;
P = test pressure prescribed for water-jacket test, i.e., at least two times service pressure, in pounds per square inch;
D = outside diameter in inches;
d = inside diameter in inches.

10. Heat treatment. (a) The completed cylinders must be uniformly and properly heat-treated prior to tests.

11. Openings in container. (a) Each opening in container, except those for safety devices, must be provided with a fitting, boss, or pad, securely attached to container by brazing or by welding or by threads. If threads are used, they must comply with the following:

(1) Threads must be clean cut, even, without checks, and tapped to gauge.

(2) Taper threads to be of length not less than as specified for American Standard taper pipe threads.

(3) Straight threads, having at least 4 engaged threads, to have tight fit and calculated shear strength at least 10 times the test pressure of the container; gaskets required, adequate to prevent leakage.

(b) Closure of fitting, boss, or pad must be adequate to prevent leakage.

12. Safety devices and protection for valves, safety devices, and other connections, if applied. (a) Devices must be as required by the Canadian Transport Commission regulations that apply (see §§ 73.34 (d) and 73.301 (g)).

13. Hydrostatic test. (a) By water-jacket, or other suitable method, operated so as to obtain accurate data. Pressure gauge must permit reading to accuracy of 1 per cent. Expansion gauge must permit reading of total expansion to accuracy either of 1 per cent or 0.1 cubic centimetre.

(b) Pressure must be maintained for 30 seconds and sufficiently longer to insure complete expansion. Any internal pressure applied after heat-treatment and previous to the official test must not exceed 90 per cent of the test pressure. If, due to failure of the test apparatus, the test pressure cannot be maintained, the test may be repeated at a pressure increased by 10 per cent or 100 pounds per square inch, whichever is the lower.

(c) Permanent volumetric expansion must not exceed 10 per cent of total volumetric expansion at test pressure.

(d) Containers must be tested as follows:

(1) Each container to at least 2 times service pressure, or

(2) One container out of each lot of 200 or less to at least 3 times service pressure. Others must be examined under pressure of 2 times service pressure and show no defects.

14. Flattening test for spheres and cylinders. (a) Flattening test for spheres. Between parallel steel plates on a press with welded seam at right angles to the plates; test one sphere taken at random out of each lot of 200 or less after hydrostatic test. Any projecting appurtenances may be cut off (by mechanical means only) prior to crushing.

(b) Flattening test for cylinders. Between knife edges, wedge shaped, 60° angle, rounded to ½ inch radius; test one cylinder[3] taken at random out of each lot of 200 or less, after hydrostatic test.

15. Physical test and specimens for spheres and cylinders. (a) Physical test for spheres. Required on 2 specimens cut from flat representative sample plate of the same heat taken at random from the steel used to produce the sphere. This flat steel from which the 2 specimens are to be cut must receive the same heat-treatment as the spheres themselves. Sample plates to be taken for each lot of 200 or less spheres.

(b) Specimens for spheres. Specimens must be gauge length 2 inches with width not over 1½ inches; provided, that gauge length at least 24 times thickness with width not over 6 times thickness is authorized when wall of sphere is not over 3/16 inch thick.

(c) Physical test for cylinders. Required on 2 specimens cut from 1[3] cylinder taken a random out of each lot of 200 or less.

(d) Specimens for cylinders. Specimens must be gauge length 8 inches with width not over 1½ inches; or gauge length 2 inches with width not over 1½ inches; provided, that gauge length at least 24 times thickness with width not over 6 times thickness is authorized when cylinder wall is not over 3/16 inch thick. The specimen, exclusive of grip ends, must not be flattened. Grip ends may be flattened to within 1 inch of each end of the reduced section. Heating of specimen for any purpose is not authorized.

(e) The yield strength in tension shall be the stress corresponding to a permanent strain of 0.2 per cent of the gauge length.

(1) The yield strength shall be determined by either the "offset" method or the "extension under load" method as prescribed in ASTM Standard E8-57T.

(2) In using the "extension under load" method, the total strain (or "extension under load") corresponding to the stress at which the 0.2 per cent permanent strain occurs may be determined with sufficient accuracy by calculating the elastic extension of the gauge length under appropriate load and adding thereto 0.2 per cent of the gauge length. Elastic extension calculations shall be based on an elastic modulus of 30,000,000. In the event of controversy, the entire stress-strain diagram shall be plotted and the yield strength determined from the 0.2 per cent offset.

(3) For the purpose of strain, measurement, the initial strain shall be set while the specimen is under a stress of 12,000 pounds per square inch, the strain indicator reading being set at the calculated corresponding strain.

(4) Cross-head speed of the testing machine shall not exceed ⅛ inch per minute during yield strength determination.

16. Acceptable results for physical and flattening tests. (a) Elongation at least 40 per cent for 2 inch gauge length or at least 20 per cent in other cases; yield strength not over 73 per cent of tensile strength; flattening test not required.

(b) Elongation at least 20 per cent for 2 inch gauge length or 10 per cent in other cases; flattening required to 50 per cent of the original outside diameter without cracking.

17. Rejected cylinders. (a) Reheat-treatment authorized; subsequent thereto acceptable containers must pass all prescribed tests. Repair of welded seams by welding prior to reheat-treatment authorized.

18. Marking. (a) Marking on each container by stamping plainly and permanently only where the metal is at least 0.09 inch thick, or on a metal name-plate permanently secured to the container by means other than soft solder, or by means that would not reduce the wall thickness, as follows:

(1) CTC-4D followed by the service pressure (for example, CTC-4D300, etc.).

(2) A serial[1] number and an identifying symbol (letters); location[2] of number to be just below or immediately following the CTC mark; location[2] of symbol to be just below or immediately following the number. The symbol and number must be those of purchaser, user, or maker. The symbol

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[1] Lot numbers not over 500 cylinders in each lot, authorized for cylinders not over 2 inches outside diameter and for cylinders over 2 inches outside diameter when the volumetric capacity does not exceed 60 cubic inches.

[2] Symbol in front or following the number with ample space between is also authorized. Other variation in location authorized only when necessitated by lack of space.

[3] For lots of 30 or less, physical and flattening tests are authorized to be made on a ring at least 8 inches long cut from each cylinder and subjected to the same heat treatment as the finished cylinder.

must be registered with the Bureau of Explosives through the Canadian Transport Commission; duplications unauthorized.

Examples:	CTC-4D300	CTC-4D300-1234-XY
	1234	
	XY	

(3) Inspector's official mark, near serial number; date of test (such as 8-50 for August 1950), so placed that dates of subsequent tests can be easily added.

19. Size of marks. (a) Of sufficient size to be legible.

20. Inspector's report. (a) Required to be clear, legible, and in the following form:

(Place) .....
(Date) .....

Gas
(spheres-cylinders)
Manufactured for .....Company
Location at .....
Manufactured for Company
Location at .....
Consigned to .....Company
Location at .....
Quantity .....
Size ..... inches outside diameter by .....inches long.
Marks stamped into the .....
(shoulder-metal plate)

(Sec. 18)
Specification CTC
Serial numbers ....to inclusive.
Inspector's mark
Identifying symbol (registered)
Test date
Tare weights (yes or no)
Other marks (if any) .....
Those containers were made by process of .....

.....
The material used was identified by the following .....numbers
(heat-purchase order)

The material used was verified as to chemical analysis and record thereof is attached hereto. The heat numbers .....
(were—were not)
marked on the material.

All material, such as plates, billets and seamless tubing, was inspected and each container was inspected both before and after closing in the ends; all that was accepted was found free from seams, cracks, laminations, and other defects which might prove injurious to the strength of the container. The processes of manufacture and heat treatment of containers were supervised and found to be efficient and satisfactory.

The container walls were measured and the minimum thickness noted was..... inch. The outside diameter was determined by a close approximation to be .....inches. The wall stress was calculated to be.....pounds per square inch under an internal pressure of.....pounds per square inch.

Hydrostatic tests, flattening tests, tensile tests of material, and other tests, as prescribed in specification No. CTC-4D were made in the presence of the inspector and all material and containers accepted were found to be in compliance with the requirements of that specification. Records thereof are attached hereto.

I hereby certify that all of these containers proved satisfactory in every way and comply with the requirements of Canadian Transport Commission specification No. 4D except as follows:
Exceptions .....

(Signed)
Inspector.

[1] The "service pressure" limits the use of the container. It is shown by marks on container; for example, CTC-4DA500 indicates the service pressure as 500 pounds per square inch.

(Place)
(Date)

RECORD OF CHEMICAL ANALYSIS OF MATERIAL FOR CONTAINERS

Numbered.....to.....inclusive.
Size ..... inches outside diameter by .....inches long.
Made by .....Company
For .....Company

Note: Any omission of analyses by heats, if authorized, must be accounted for by notation hereon reading, "The prescribed certificate of the manufacturer of material has been secured, found satisfactory, and placed on file", or by attaching a copy of the certificate.

Test No.	Heat No.	Check analysis No.	Containers represented (Serial) Nos.)	Chemical analysis						
				C	P	S	Si	Mn	Ni	Cr

The analyses were made by
(Signed)

(Place) ....
(Date)

RECORD OF PHYSICAL TESTS OF MATERIAL FOR CONTAINERS

Numbered.....to.....inclusive.
Size..... inches outside diameter by.....inches long.
Made by Company
For .....Company

Test No.	Containers represented by test (Serial Nos.)	Yield strength (pounds per square inch)	Tensile strength (pounds per square inch)	Elongation (per cent in 8 inches)	Reduction of area (per cent	Flattening test

(Signed)

Specification 4DA

INSIDE CONTAINERS WELDED STEEL

for aircraft use

1. Compliance. (a) Required in all details.

2. Type, size, and service pressure. (a) Type and size. Welded steel spheres (two seamless hemispheres) or circumferentially welded cylinders (two seamless drawn shells) not over 100 pounds water capacity.

(b) Service pressure.[1] At least 500 to not over 900 pounds per square inch.

3. Inspection by whom and where. By competent and independent Inspector approved by the Canadian Transport Commission. For cylinders not made in Canada, or the United States of America, the tests, as specified, shall be

made within the limits of Canada, unless written permission is obtained from the Commission to conduct the tests elsewhere.

4. Duties of inspector. (a) Inspect all material and reject any not complying with requirements.

(b) Verify chemical analysis of each heat of material by analysis or by obtaining certified analysis: Provided, That a certificate from the manufacturer thereof, giving sufficient data to indicate compliance with requirements, is acceptable when verified by check analyses of samples taken from one container out of each lot of 200 or less.

(c) Verify compliance of containers with all requirements including markings; inspect inside before closing; verify heat treatment and welding procedure as proper; obtain samples for all tests and check chemical analyses; witness all tests; verify threads by gauge; report volumetric capacity and tare weight and minimum thickness of wall noted.

(d) Render complete report required by this specification to cylinder maker, Canadian Transport Commission and upon request to the purchaser.

5. Steel. (a) Open-hearth or electric steel of uniform quality. The following chemical analyses are authorized, (see Note 1):

4130	Per cent
Carbon	0.28/0.33
Manganese	0.40/0.60
Phosphorus	0.040 max.
Sulphur	0.040 max.
Silicon	0.20/0.35
Chromium	0.80/1.10
Molybdenum	0.15/0.25

Note 1: A heat of steel made under the above specifications, check chemical analysis of which is slightly out of the specified range, is acceptable, if satisfactory in all other respects, provided the tolerances shown in the following table are not exceeded except as approved by the Commission or Bureau of Explosives:

CHECK ANALYSIS TOLERANCES

Element	Limit or maximum specified (per cent)	Tolerance (per cent) over the maximum limit or under the minimum limit	
		Under minimum limit	Over maximum limit
Carbon	Over 0.15 to 0.40 incl	0.03	0.04
Manganese	To 0.60 incl	0.03	0.03
Phosphorus[1]	All ranges		0.01
Sulphur	All ranges		0.01
Silicon	To 0.30 incl	0.02	0.03
	Over 0.30 to 1.00 incl	0.05	0.05
Chromium	To 0.90 incl	0.03	0.03
	Over 0.90 to 2.10 incl	0.05	0.05
Molybdenum	To 0.20 incl	0.01	0.01
	Over 0.20 to 0.40 incl	0.02	0.02

[1] Rephosphorized steels not subject to check analysis for phosphorus.

6. Identification of material. (a) Required; any suitable method except that plates and billets for hot-drawn containers shall be marked with heat number.

7. Defects. (a) Material with seams, cracks, laminations, or other injurious defects, not authorized. Defects in welded joints shall not exceed the limits specified in paragraph 17 covering radiographic inspection.

8. Manufacture. (a) By best appliances and methods; dirt and scale to be removed as necessary to afford proper inspection; not defect acceptable that is likely to weaken the finished container appreciably, reasonably smooth and uniform surface finish required. No abrupt change in wall thickness permitted. Certification of welders and/or process required in accordance with the sections that apply of CGA Pamphlet C-3.

(b) All seams of the sphere or cylinders must be fusion welded. Seams shall be of the butt or joggle butt type and means must be provided for accomplishing complete penetration of the joint.

9. Welding. (a) Attachments to the container are authorized by fusion welding provided that such attachments are made of weldable steel, the carbon content of which must not exceed 0.25 per cent except in the case of 4130 steel.

10. Wall thickness. (a) The minimum wall thickness shall be such that the wall stress at the minimum specified test pressure shall not exceed 67 per cent of the minimum tensile strength of the steel as determined from the physical and burst tests required and shall not be over 70,000 psi. Minimum wall .040 inch for any diameter container.

(b) Calculation for a sphere must be made by the formula:

$$S = \frac{PD}{4tE}$$

where:

S = wall stress in pounds per square inch;
P = test pressure prescribed for water-jacket test, i.e., at least two times service pressure, in pounds per square inch;
D = outside diameter in inches;
t = minimum wall thickness in inches;
E = 0.85 (provides 85 per cent weld efficiency factor which must be applied in the girth weld area and heat affected zones which zone shall extend a distance of 6 times wall thickness from centre line of weld);
E = 1.0 (for all other areas).

(c) Calculation for a cylinder must be made by the formula:

$$S = \frac{P\,(1.3D^2 + 0.4d^2)}{D^2 - d^2}$$

where:

S = wall stress in pounds per square inch;
P = test pressure prescribed for water-jacket test, i.e., at least two times service pressure, in pounds per square inch;
D = outside diameter in inches;
d = inside diameter in inches.

11. Heat treatment. (a) The completed containers must be uniformly and properly heat-treated prior to tests. Heat-treatment of containers of the authorized analysis shall be as follows:

(1) All containers must be quenched by oil, or other suitable medium except as provided in subparagraph (4) of this paragraph.

(2) The steel temperature on quenching shall be that recommended for the steel analysis, but in no case shall exceed 1750°F.

(3) The steel shall be tempered at the temperature most suitable for the analysis except that in no case shall the tempering temperature be less than 1000°F.

(4) The steel may be normalized at a temperature of 1650°F. instead of being quenched, and containers so normalized need not be tempered.

(5) (Cancelled).

(6) All cylinders, if water quenched or quenched with a liquid producing a cooling rate in excess of 80 per cent of the cooling rate of water, must be inspected by the magnetic particle or dye penetrant method to detect the presence of quenching cracks. Any cylinder found to have a quench crack must be rejected and may not be requalified.

12. Openings in container. (a) Each opening in the container must be provided with a fitting, boss, or pad of weldable steel securely attached to the container by fusion welding.

(b) Attachments to a fitting, boss, or pad must be adequate to prevent leakage. Threads must comply with the following:

(1) Threads must be clean cut, even, without checks, and tapped to gauge.

(2) Taper threads to be of length not less than as Specified for American Standard taper pipe threads.

(3) Straight threads, having at least 4 engaged threads, to have tight fit and calculated shear strength at least 10 times the test pressure of the container; gaskets required, adequate to prevent leakage.

13. Safety devices. (a) Safety relief devices must be as required by the Canadian Transport Commission Regulations. (See § 73.34(d).)

14. Hydrostatic test. (a) By water-jacket, or other suitable method, operated so as to obtain accurate data. Pressure gauge must permit reading to accuracy of 1 per cent. Expansion gauge must permit reading of total expansion to accuracy either of 1 per cent or 0.1 cubic centimetre.

(b) Pressure must be maintained for 30 seconds and sufficiently longer to insure complete expansion. Any internal pressure applied after heat-treatment and previous to the official test must not exceed 90 per cent of the test pressure. If, due to failure of the test apparatus, the test pressure cannot be maintained, the test may be repeated at a pressure increased by 10 per cent or 100 pounds per square inch, whichever is the lower.

(c) Permanent volumetric expansion must not exceed 10 per cent of total volumetric expansion at test pressure.

(d) Each container must be tested to at least 2 times service pressure.

15. Burst test. (a) One container taken at random out of 200 or less shall be hydrostatically tested to destruction. Rupture pressure shall be included as part of the inspector's report.

16. Flattening test. (a) Flattening test for spheres. At the weld between parallel steel plates on a press with welded seam at right angles to the plates, test one sphere taken at random out of each lot of 200 or less after hydrostatic test. Any projecting appurtenances may be cut off (by mechanical means only) prior to crushing.

(b) Flattening test for cylinders. Between knife edges, wedge shaped, 60° angle, rounded to ½ inch radius; test one cylinder taken at random out of each lot of 200 or less, after hydrostatic test.

17. Radiographic inspection. (a) Required on all welded joints which are subjected to internal pressure, except that at the discretion of the disinterested inspector, openings less than 25 per cent of the sphere diameter need not be subjected to radiographic inspection. Evidence of any defects likely to seriously weaken the container shall be cause for rejection.

18. Physical test and specimens for spheres and cylinders. (a) Physical test for spheres. Required on 2 specimens cut from flat representative sample plate of the same heat taken at random from the steel used to produce the sphere. This flat steel from which the 2 specimens are to be cut must receive the same heat-treatment as the spheres themselves. Sample plates to be taken for each lot of 200 or less spheres.

(b) Specimens for spheres. Specimens must be gauge length 2 inches with width not over 1½ inches; Provided, That gauge length at least 24 times thickness with width not over 6 times thickness is authorized when wall of sphere is not over 3/16 inch thick.

(c) Physical test for cylinders. Required on 2 specimens cut from 1 cylinder taken at random out of each lot of 200 or less.

(d) Specimens for cylinders. Specimens must be gauge length 8 inches with width not over 1½ inches; or gauge length 2 inches with width not over 1½ inches; Provided, That gauge length at least 24 times thickness with width not over 6 times thickness is authorized when cylinder wall is not over 3/16 inch thick. The specimen, exclusive of grip ends, must not be flattened. Grip ends may be flattened to within 1 inch of each end of the reduced section. Heating of specimen for any purpose is not authorized.

(e) The yield strength in tension shall be the stress corresponding to a permanent strain of 0.2 per cent of the gauge length.

(1) The yield strength shall be determined by either the "offset" method or the "extension under load" method as prescribed in ASTM Standard E8-57T.

(2) In using the "extensions under load" method, the total strain (or "extension under load") corresponding to the stress at which the 0.2 per cent permanent strain occurs may be determined with sufficient accuracy by calculating the elastic extension of the gauge length under appropriate load and adding thereto 0.2 per cent of the gauge length. Elastic extension calculations shall be based on an elastic modulus of 30,000,000. In the event of controversy, the entire stress strain diagram shall be plotted and the yield strength determined from the 0.2 per cent offset.

(3) For the purpose of strain measurement, the initial strain shall be set while the specimen is under a stress of

12,000 pounds per square inch, the strain indicator reading being set at the calculated corresponding strain.

(4) Cross-head speed of the testing machine shall not exceed ⅛ inch per minute during yield strength determination.

19. Acceptable results for physical, flattening, and burst tests. (a) Elongation at least 20 per cent for 2 inch gauge length or 10 per cent in other cases.

(b) Flattening required to 50 per cent of the original outside diameter without cracking.

(c) Burst pressure shall be at least 3 times service pressure.

20. Rejected containers. (a) Reheat-treatment authorized; subsequent thereto, acceptable containers must pass all prescribed tests. Repair of welded seams by welding prior to reheat-treatment authorized.

21. Marking. (a) Marking on each container by stamping plainly and permanently only on a permanent attachment or on a metal nameplate permanently secured to the container by means other than soft solder, as follows:

(1) CTC-4DA followed by the service pressure (for example, CTC-4DA900)

(2) A serial[3] number and an identifying symbol (letters); location[4] of number to be just below or immediately following the CTC mark; location[4] of symbol to be just below or immediately following the number. The symbol and number must be those of purchaser, user, or maker. The symbol must be registered with the Bureau of Explosives through the Canadian Transport Commission; duplications unauthorized.

Examples: CTC-4DA900 CTC-4DA900-1234-XY
1234
XY

(3) Inspector's official mark, near serial number, date of test (such as 8-50 for August 1950), so placed that dates of subsequent tests can be easily added.

22. Size of marks. (a) Of sufficient size to be legible.

23. Inspector's report. (a) Required to be clear, legible, and in the following form:

(Place)

(Date)

Gas .....
(spheres-cylinders)

Manufactured for .....Company

Location at

Manufactured by .....Company

Location at

Consigned to .....Company

Location at

Quantity

Size .....inches outside diameter by.....inches long.

Marks stamped into the

.....
(Shoulder-metal plate, paragraph 21)

Specification CTC
Serial numbers ..... to ..... inclusive

Inspector's mark
Identifying symbol (registered)
Test date
Tare weights (yes or no).....
Other marks (if any) .....
These containers were made by process of

.....

The material used was identified by the following.....
(heat-purchase order)
numbers .....

The material used was verified as to chemical analysis and record thereof is attached hereto. The heat numbers .....
(were—were not)
marked on the material.

All material, such as plates, billets and seamless tubing, was inspected and each container was inspected both before and after closing in the ends; all that was accepted was found free from seams, cracks, laminations, and other defects which might prove injurious to the strength of the container. The processes of manufacture and heat treatment of containers were supervised and found to be efficient and satisfactory.

The container walls were measured and the minimum thickness noted was.....inch. The outside diameter was determined by a close approximation to be.....inches. The wall stress was calculated to be.....pounds per square inch under an internal pressure of.....pounds per square inch.

Hydrostatic tests, flattening tests, tensile tests of material, and other tests, as prescribed in specifications No. CTC-4DA were made in the presence of the inspector and all material and containers accepted were found to be in compliance with the requirements of that specification. Records thereof are attached hereto.

I hereby certify that all of these containers proved satisfactory in every way and comply with the requirements of the Canadian Transport Commission specification No. 4DA except as follows:

Exceptions .....

.....

(Signed) .....
Inspector

(Place)

(Date)

RECORD OF CHEMICAL ANALYSIS OF MATERIAL FOR CONTAINERS

Numbered.....to.....inclusive.

Size.....inches outside diameter by.....inches long.

Made by Company

For Company

NOTE: Any omission of analyses by heats, if authorized, must be accounted for by notation hereon reading. "The prescribed certificate of the manufacturer of material has been secured, found satisfactory, and placed on file," or by attaching a copy of the certificate.

Test No.	Heat No.	Check analysis No.	Containers represented (Serial) Nos.)	Chemical analysis						
				C	P	S	Si	Mn	Ni	Cr

The analyses were made by.....
(Signed)

[3] Lot numbers not over 500 cylinders in each lot, authorized for cylinders not over 2 inches outside diameter and for cylinders over 2 inches outside diameter when the volumetric capacity does not exceed 60 cubic inches.

[4] Symbol in front or following the number with ample space between is also authorized. Other variation in location authorized only when necessitated by lack of space.

(Place)

(Date) .....

RECORD OF PHYSICAL TESTS OF MATERIAL FOR CONTAINERS

Numbered .....to.....inclusive.

Size .....inches outside diameter by.....inches long.

Made by .....Company

For .....Company

Test No.	Containers represented by test (Serial Nos.)	Yield strength (pounds per square inch)	Tensile strength (pounds per square inch)	Elogantion (per cent in 8 inches)	Reduction of area (per cent)	Flattening test
.....	.....	.....	.....	.....	.....	.....

(Signed)..

(Place)

(Date)..

RECORD OF HYDROSTATIC TESTS ON CONTAINERS

Numbered.....to.....inclusive

Size.....inches outside diameter by.....inches long.

Made by .....Company

For .....Company

Serial numbers of containers tested arranged numerically	Actual test pressure (pounds per square inch)	Total expansion (cubic centimetres)[1]	Permanent expansion (cubic centimetres)[5]	Per cent ratio of permanent expansion to total expansion[5]	Tare weight (pounds)[6]	Volumetric capacity

NOTE: When specifications require test for only 1 out of each of 200 or less containers, the check on the others must be indicated by a notation hereon reading "Each container was subjected to a pressure of.....pounds per square inch and showed no defect."

[5] If the tests are made by a method involving the measurement of the amount of liquid forced into the container by the test pressure, then the basic data, on which the calculations are made, such as the pump factors, temperature of liquid, coefficient of compressibility of liquid, etc., must also be given.

[6] Do not include removable cap but state whether with or without valve. Those weights must be accurate to a tolerance of 1 per cent.

(Signed)

Specification 4DS

INSIDE CONTAINERS

(Welded Stainless Steel for Aircraft use)

1. Compliance. (a) Required in all details.

2. Type, size and service pressure. (a) Type and size, welded stainless steel spheres (two seamless hemispheres) or circumferentially welded cylinders not over 100 pounds water capacity.

(b) Service pressure[1]. At least 500 to not over 900 pounds per square inch.

3. Inspection by whom and where. By competent and independent Inspector approved by the Canadian Transport Commission. For cylinders not made in Canada, or the United States of America, the tests, as specified, shall be made within the limits of Canada, unless written permission is obtained from the Commission to conduct the tests elsewhere.

4. Duties of inspector. (a) Inspect all material and reject any not complying with requirements.

(b) Verify chemical analysis of each heat of material by analysis or by obtaining certified analysis; provided, that a certificate from the manufacturer thereof, giving sufficient data to indicate compliance with requirements, is acceptable when verified by check analyses of samples taken from one container out of each lot of 200 or less.

(c) Verify compliance of containers with all requirements including markings; inspect inside before closing; verify heat treatment and welding procedure as proper; obtain samples for all tests and check chemical analyses; witness all tests; verify threads by gauge; report volumetric capacity and tare weight and minimum thickness of wall noted. Verify that all tests are conducted at temperatures between 60°F. and 90°F.

(d) Render complete report required by this specification to cylinder maker, Canadian Transport Commission and upon request to the purchaser.

5. Steel. (a) Types 304, 321 and 347 stainless steel are authorized with proper welding procedure and complying with the following analyses:

	Stainless steels		
	304 (per cent)	321 (per cent)	347 (per cent)
Carbon (maximum)	0.08	0.08	0.08
Manganese (maximum)	2.00	2.00	2.00
Phosphorous (maximum)	.030	.030	.030
Sulphur (maximum)	.030	.030	.030
Silicon (maximum)	.75	.75	.75
Nickel	8.0/11.0	9.0/13.0	9.0 13.0
Chromium	18.0/20.0	17.0/20.0	17.0/20.0
Molybdenum	.....	.....	.....
Titanium		[1]	
Columbium			[2]

[1] Titanium shall be not less than 5 × C and not more than 0.6 per cent.
[2] Columbium shall not be less than 10 × C and not more than 1.0 per cent.
®NOTE 1: A heat of steel made under the above specifications, check chemical analysis of which is slightly out of the specified range, is acceptable, if satisfactory in all other respects, provided the tolerances shown in the following table are not exceeded except as approved by the Commission or Bureau of Explosives:

CHECK ANALYSIS TOLERANCES

Element	Limit or maximum specified (per cent)	Tolerance (per cent) over the maximum limit or under the minimum limit	
		Under minimum limit	Over maximum limit
Carbon	To 0.15 incl.	0.01	0.01
Manganese	Over 1.15 to 2.50 incl	0.05	0.05
Phosphorus*	All ranges		0.01
Sulphur	All ranges		0.01
Silicon	Over 0.30 to 1.00 incl	0.05	0.05
Nickel	Over 5.30 to 10.00 incl	0.10	0.10
	Over 10.00 to 14.00 incl	0.15	0.15
Chromium	Over 15.00 to 20.00 incl	0.20	0.20
Titanium	All ranges	0.05	0.05
Columbium	All ranges	0.05	0.05

*Rephosphorized steels not subject to check analysis for phosphorus.
®1The "service pressure" limits the use of the container. It is shown by marks on container; for example CTC-4DS500 indicates the service pressure as 500 pounds per square inch.

6. Identification of material. (a) Required; any suitable method.

7. Defects. (a) Material with seams, cracks, laminations, or other injurious defects, not authorized. Defects in welded joints shall not exceed the limits specified in paragraph 16 covering radiographic inspection.

8. Manufacture. (a) By best appliances and methods; dirt and scale to be removed as necessary to afford proper inspection; no defect acceptable that is likely to weaken the finished container appreciably, reasonably smooth and uniform surface finish required. No abrupt change in wall thickness permitted. Certification of welders and/or process required in accordance with the sections that apply of CGA Pamphlet C-3.

(b) All seams of the sphere or cylinder must be fusion welded. Seams shall be of the butt type and means must be provided for accomplishing complete penetration of the joint.

9. Attachments. (a) Attachments to the container are authorized by fusion welding provided that such attachments are made of weldable stainless steel in accordance with paragraph 5.

10. Wall thickness. (a) The minimum wall thickness shall be such that the wall stress at the minimum specified test pressure shall not be over 60,000 psi. Minimum wall .040 inch for any diameter container.

(b) Calculation for sphere must be made by the formula:

11. Heat treatment. (a) The seamless hemispheres and cylinders may be stress relieved or annealed for forming. Welded container shall be stress relieved at a temperature of 775°F. ± 25° after process treatment and before hydrostatic test.

12. Openings in container. (a) Each opening in the container must be provided with a fitting, boss, or pad of weldable stainless steel securely attached to the container by fusion welding.

(b) Attachments to a fitting, boss, or pad must be adequate to prevent leakage. Threads must comply with the following:

$$S = \frac{PD}{4tE}$$

where:

S = Wall stress in pounds per square inch;
P = Test pressure prescribed for water jacket test, i.e., at least two times service pressure, in pounds per square inch;
D = Outside diameter in inches;
t = Minimum wall thickness in inches;
E = 0.85 (provides 85 per cent weld efficiency factor which must be applied in the girth weld area and heat zones which zone shall extend a distance of 6 times wall thickness from centre of weld);
E = 1.0 (for all other areas).

(c) Calculation for a cylinder must be made by the formula:

$$S = \frac{P\,(1.3D^2 + 0.4d^2)}{D^2 - d^2}$$

where:

S = Wall stress in pounds per square inch;
P = Test pressure prescribed for water jacket test, i.e., at least two times service pressure, in pounds per square inch;
D = Outside diameter in inches;
d = Inside diameter in inches.

(1) Threads must be clean cut, even, without checks, and tapped to gauge.

(2) Taper threads to be of length not less than as specified for American Standard taper pipe threads.

(3) Straight threads, having at least 4 engaged threads, to have tight fit and calculated shear strength at least 10 times the test pressure of the container; gaskets required, adequate to prevent leakage.

⑨ **13. Safety relief devices.** (a) Safety relief devices must be as required by the Commission's Regulations that apply (see § 73.34(d)).

14. Process treatment. (a) Each container shall be hydraulically pressurized in a water jacket to at least 100 per cent, but not more than 110 per cent, of the test pressure and maintained at this pressure for a minimum of 3 minutes. Total and permanent expansion shall be recorded and included in the inspector's report.

15. Hydrostatic test. By water-jacket, operated so as to obtain accurate data. Pressure gauge must permit reading to an accuracy of 1 per cent. Expansion gauge must permit reading of total expansion to accuracy either of 1 per cent or 0.1 cubic centimeter.

(b) Pressure must be maintained for 30 seconds and sufficiently longer to insure complete expansion. If, due to failure of the test apparatus, the test pressure cannot be

maintained, the test may be repeated at a pressure increased by 10 per cent or 100 pounds per square inch, whichever is the lower.

(c) Permanent volumetric expansion must not exceed 10 per cent of total volumetric expansion at test pressure.

(d) Each container must be tested to at least 2 times service pressure.

(e) Container will then be inspected. Wall thickness lower than that required by paragraph 10 shall be cause for rejection. Bulges and cracks shall be cause for rejection. Weld joint defects exceeding requirements of paragraph 16 shall be cause for rejection.

16. Radiographic inspection. (a) Required on all welded joints which are subjected to internal pressure, except that at the discretion of the disinterested inspector, openings less than 25 per cent of the container diameter need not be subjected to radiographic inspection. Evidence of any defects likely to seriously weaken the container shall be cause for rejection.

(b) Radiographic inspection shall be performed subsequent to hydrostatic test.

17. Burst test. (a) One container taken at random out of 200 or less shall be hydrostatically tested to destruction. Rupture pressure shall be included as part of the inspector's report.

18. Flattening test. (a) Flattening test for spheres. At the weld between parallel steel plates on a press with welded seam at right angles to the plates, test one sphere taken at random out of each lot of 200 or less after hydrostatic test. Any projecting appurtenances may be cut off (by mechanical means only) prior to crushing.

(b) Flattening test for cylinders. Between knife edges, wedge shaped, 60° angle, rounded to ½ inch radius; test one cylinder taken at random out of each lot of 200 or less, after hydrostatic test.

19. Acceptable results for flattening and burst tests. (a) Flattening required to 50 per cent of the original outside diameter without cracking.

(b) Burst pressure shall be at least 3 times service pressure.

20. Rejected containers. (a) Repair of welded seams by welding prior to process treatment authorized; subsequent thereto containers must be heat treated and pass all prescribed tests.

21. Marking. (a) Marking on each container by stamping plainly and permanently only on a permanent attachment or on a metal nameplate permanently secured to the container by means other than soft solder, as follows:

(1) CTC-4DS followed by the service pressure (for example: CTC-4DS900).

(2) A serial number and an identifying symbol (letters) location of a number to be just below the CTC mark; location of symbol to be just below the number. The symbols and numbers must be those of purchaser, user, or maker. The symbol must be registered with the Bureau of Explosives, duplications unauthorized;

Example: CTC-4DS900
1234
XY

(3) Inspector's official mark, near serial number, date of test (such as 8-61 for August 1961) so placed that dates of subsequent tests can be easily added.

22. Size of marks. (a) Of sufficient size to be legible.

23. Inspector's report. (a) Required to be clear, legible and in the following form:

(Place)
(Date)...
Gas
(spheres-cylinders)
Manufactured for .....Company
Location at
Manufactured by .....Company
Location at
Consigned to .....Company
Location at
Quantity
Size..... .....inches outside diameter by.....inches long.
Marks stamped into the
(Shoulder-metal plate, paragraph 21)
Specification CTC .....
Serial numbers.....inclusive
Inspector's mark
Identifying symbol (registered)
Test date.....
Tare weights (yes or no)...
Other marks (if any)
These containers were made by process of

The material used was verified as to chemical analysis and record thereof is attached hereto. The heat number.....
(were—were not)
marked on the material.

All material, such as plates and seamless tubing, was inspected and each container was inspected before and after closing in the ends; all that were accepted were found free from seams, cracks, lamination, and other defects which might prove injurious to the strength of the container. The process of manufacture of containers were supervised and found to be efficient and satisfactory.

The container walls were measured and the minimum thickness noted was.... ..inch. The outside diameter was determined by a close approximation to be.....inches. The wall stress was calculated to be.....pounds per square inch under and internal pressure of..... pounds per square inch.

Hydrostatic tests, flattening tests and other tests, as prescribed in specification No. CTC-4DS were made in the presence of the inspector and all material and containers accepted were found to be in compliance with the requirements of that specification. Records thereof are attached hereto.

I hereby certify that all of these containers proved satisfactory in every way and comply with the requirements of Canadian Transport Commission specification No. 4DS except as follows:

Exceptions

(Signed)
Inspector
(Place)
(Date)

RECORD OF CHEMICAL ANALYSIS OF MATERIAL FOR CONTAINERS

Numbered.....inclusive
Size.....inches outside diameter by.....inches long.
Made by .....Company
For .....Company

NOTE: Any omission of analysis by heats, if authorized, must be accounted for by notation hereon reading "The prescribed certificate of the manufacturer of material has been secured, found satisfactory, and placed on file," or by attaching a copy of the certificate.

Test No.	Heat No.	Check analysis No.	Containers represented (Serial Nos.)	Chemical analysis						
				C	P	S	Si	Mn	Ni	Cr

The analyses were made by .....

(Signed) .....

(Place) .....

(Date) .....

RECORD OF PHYSICAL TESTS OF MATERIAL FOR CONTAINERS

Numbered.....to... .....inclusive.

Size .....inches outside diameter by.....inches long.

Made by .....Company

For .....Company

Test No.	Containers represented by test (Serial Nos.)	Rupture pressure (pounds per square inch)	Flattening test

(Signed) .....

(Place) .....

(Date) .....

RECORD OF HYDRO STATIC TESTS ON CONTAINERS

Numbered ..... inclusive

Size ..... inches outside diameter by ..... inches long.

Made by ..... Company

For ..... Company

Serial numbers of containers tested arranged numerically	Process pressure (pounds per square inch)	Total expansion at process pressure (cubic centimeters)	Permanent expansion at process pressure (cubic centimeters)	Actual test pressure (pounds per square inch)	Total expansion at test pressure (cubic centimeters)	Permanent expansion at test pressure (cubic centimeters)	Per cent ratio of permanent expansion to total expansion	Tare weight (pounds)	Volumetric capacity

NOTE: When specifications require test for only one out of each lot of 200 or less containers, the check on the others must be indicated by a notation hereon reading, "Each container was subjected to a pressure of ..... pounds per square inch and shows no defect."

(Signed) .....

Specification 4E

WELDED ALUMINUM CYLINDERS

1. Compliance. (a) Required in all details.

2. Type, size, and service pressure. (a) Type and size. Must be constructed of not more than two seamless drawn shells with no more than one circumferential weld. The circumferential weld must not be closer to the point of tangency of the cylindrical portion with the shoulder than 20 times the cylinder wall thickness. Cylinders or shells closed in by spinning process and cylinders with longitudinal seams are not authorized. Authorized for not over 1,000 pounds water capacity (nominal).

(b) Service pressure.[1] At least 225 to not over 500 pounds per square inch.

3. Inspection by whom and where. (a) By competent and independent inspector approved by the Canadian Transport Commission.

(b) Except as provided in paragraph (c) of this section, for cylinders not made in Canada the tests, as specified, shall be made within the limits of Canada unless written permission is obtained from the Commission to conduct the tests elsewhere.

(c) Notwithstanding paragraph (b) of this section cylinders made within the United States of America shall not be transported by rail in Canada unless they have been fabricated and tested in complete accordance with the applicable CTC or DOT Specification under the supervision of a representative from an independent inspection agency approved by the Commission.

4. Duties of inspector. (a) Inspect all material and reject any material not complying with requirements.

(b) Verify chemical analysis of each lot of material by analysis or by obtaining certified analysis: Provided, That a certificate from the manufacturer thereof, giving sufficient data to indicate compliance with requirements, is acceptable when verified by check analysis of samples taken from one aluminum cylinder out of each lot of 200 or less.

(c) Verify compliance of cylinders with all requirements including markings; inspect inside before closing in both ends; verify properties as proper; obtain samples for all tests and check chemical analysis; witness all tests; verify threads by gauge; report volumetric capacity, tare weight (see report form) and wall thickness as approved.

(d) Render complete report required by this specification to cylinder maker, Canadian Transport Commission and upon request to the purchaser.

[1] Analysis shall regularly be made only for the elements specifically mentioned above. If, however, the presence of other elements is indicated in the course of routine analysis, further analysis should be made to determine conformance with the limits specified for other elements.

TABLE I—AUTHORIZED MATERIALS

Designation	Chemical analysis—limits in per cent 5154[1]
Iron plus silicon	0.45 max.
Copper	0.10 max.
Manganese	0.10 max.
Magnesium	3.1/3.9
Chromium	0.15/0.35
Zinc	0.20 max.
Titanium	0.20 max.
Others, each	0.05 max.
Others, total	0.15 max.
Aluminum	Remainder

[1] The "service pressure" limits the use of the cylinder. It is shown by marks on the cylinder; for example: CTC-4E240 indicates the service pressure as 240 pounds per square inch.

5. Aluminum. (a) Shall be of uniform quality. The following chemical analyses are authorized:

6. Identification of material. (a) Required; any suitable method that will identify the alloy and manufacturer's lot number.

7. Defects. (a) Material with seams, cracks, laminations or other injurious defects not authorized.

8. Manufacture. (a) By best processes and methods; dirt and foreign particles to be removed as necessary to afford proper inspection; no defect acceptable that is likely to weaken the finished cylinder appreciably; reasonably smooth and uniform surface finish required; all welding must be by the gas shielded arc process.

9. Welding. (a) The attachment to the tops and bottoms only of cylinders by welding of neckrings or flanges, footrings, handles, bosses and pads and valve protection rings is authorized: Provided, That such attachments and the portion of the cylinder to which it is attached are made of weldable aluminum alloys.

10. Wall thickness. (a) The minimum wall thickness of the cylinder shall be 0.140 inch. In any case, the minimum wall thickness shall be such that calculated wall stress at twice service pressure shall not exceed the lesser value of either of the following:

(1) 20,000 pounds per square inch.

(2) One-half of the minimum tensile strength of the material as required in paragraph 15.

(b) Calculation must be made by the formula:

$$S = \frac{P\,(1.3D^2 + 0.4d^2)}{D^2 - d^2}$$

where:

S = wall stress in pounds per square inch;
P = minimum test pressure prescribed for water-jacket test;
D = outside diameter in inches;
d = inside diameter in inches.

(c) Minimum thickness of heads and bottoms shall not be less than the minimum required thickness of the side wall.

11. Opening in cylinder. (a) All openings must be in the heads or bases.

(b) Each opening in cylinders, except those for safety devices, must be provided with a fitting boss, or pad, securely attached to cylinder by welding by inert gas shielded arc process or by threads. If threads are used, they must comply with the following:

(1) Threads must be clean-cut, even, without checks and cut to gauge.

(2) Taper threads to be of length not less than as specified for American Standard taper pipe threads.

(3) Straight threads, having at least 4 engaged threads, to have tight fit and calculated shear strength at least 10 times the test pressure of the cylinder; gaskets required, adequate to prevent leakage.

(c) Closure of fitting, boss, or pad must be adequate to prevent leakage.

12. Safety devices and protection for valves, safety devices, and other connections if applied. (a) Must be as required by the Commission's Regulations that apply (see §§ 73.34(d), 73.124(a), and 73.301(g).

13. Hydrostatic test. (a) By water-jacket, or other suitable method, operated so as to obtain accurate data. Pressure gauge must permit reading to accuracy of 1 per cent. Expansion gauge must permit reading of total expansion to accuracy either of 1 per cent or 0.1 cubic centimeter.

(b) Pressure of 2 times service pressure must be maintained for 30 seconds and sufficiently longer to insure complete expansion. Any internal pressure applied previous to the official test must not exceed 90 per cent of the test pressure. If, due to failure of the test apparatus, the test pressure cannot be maintained, the test may be repeated at a pressure increased by 10 per cent over the pressure otherwise specified.

(c) Permanent volumetric expansion must not exceed 12 per cent of total volumetric expansion at test pressure.

(d) Cylinders having a calculated wall stress of 18,000 pounds per square inch or less at test pressure may be tested as follows:

(1) At least one cylinder selected at random out of each lot of 200 or less shall be tested in accordance with paragraphs (a), (b) and (c) of this section.

(2) All cylinders not tested as provided in subparagraph (d) (1) of this section must be examined under pressure of at least two times service pressure and show no defect.

(e) One finished cylinder selected at random out of each lot of 1,000 or less shall be hydrostatically tested to 4 times the service pressure without bursting. Inability to meet this requirement shall result in rejection for the lot.

14. Flattening test. (a) After hydrostatic testing, a flattening test is required on one section of a cylinder, taken at random out of each lot of 200 or less as follows:

(1) If the weld is not at midlength of the cylinder, the test section must be no less in width than 30 times the cylinder wall thickness. The weld must be in the centre of the section. Weld reinforcement must be removed by machining or grinding so that the weld is flush with the exterior of the parent metal. There must be no evidence of cracking in the sample when it is flattened between flat plates to no more than 6 times the wall thickness.

(2) If the weld is at midlength of the cylinder, the test may be made as specified in subparagraph (1) of this paragraph or must be made between wedge shaped knife edges (60° angle) rounded to a ½-inch radius. There must be no evidence of cracking in the sample when it is flattened to no more than 6 times the wall thickness.

15. Physical test. (a) To determine yield strength, tensile strength, elongation, and reduction of area of material, required on 2 specimens cut from one cylinder or part thereof taken at random out of each lot of 200 or less.

(b) Specimens must be: Gauge length 8 inches with width not over 1½ inches; or gauge length 2 inches with width not over 1½ inches. The specimen, exclusive of grip ends, must not be flattened. Grip ends may be flattened

to within 1 inch of each end of the reduced section. When size of cylinder does not permit securing straight specimens, the specimens may be taken in any location or direction and may be straightened or flattened cold, by pressure only, not by blows; when specimens are so taken and prepared, the inspector's report must show in connection with record of physical tests detailed information in regard to such specimens. Heating of specimen for any purpose is not authorized.

(c) The yield strength in tension shall be the stress corresponding to a permanent strain of 0.2 per cent of the gauge length.

(1) The yield strength shall be determined by the "offset" method as prescribed in ASTM Standard E8-57 T.

(2) Cross-head speed of the testing machine shall not exceed ⅛ inch per minute during yield strength determination.

16. Acceptable results for physical tests. (a) Elongation at least 7 per cent; yield strength not over 80 per cent of tensile strength.

17. Weld tests. (a) Reduced section tensile test. A specimen shall be cut from the cylinder used for the physical tests specified in paragraph 15. Specimen shall be taken across the seam, edges shall be parallel for a distance of approximately 2 inches on either side of the weld. The specimen must be fractured in tension. The apparent breaking stress calculated on the minimum wall thickness must be at least equal to 2 times the stress calculated under paragraph 10(b), and in addition must have an actual breaking stress of at least 30,000 pounds per square inch. Should this specimen fail to meet the requirements, specimens may be taken from 2 additional cylinders from the same lot and tested. If either of the latter specimens fails to meet requirements, the entire lot represented shall be rejected.

⑨ (b) Guided bend test. A bend test specimen shall be cut from the cylinder used for the physical tests specified in paragraph 15. Specimen shall be taken across the seam, shall be 1½ inches wide, edges shall be parallel and rounded with a file, and back-up strip, if used, shall be removed by machining. The specimen shall be bent to refusal in the guided bend test jig illustrated in paragraph 6.10 of CGA Pamphlet C-3. The root of the weld (inside surface of the cylinder) shall be located away from the ram of the jig. No specimen shall show a crack or other open defect exceeding ⅛ inch in any direction upon completion of the test. Should this specimen fail to meet the requirements, specimens may be taken from each of 2 additional cylinders from the same lot and tested. If either of the latter specimens fail to meet requirements, the entire lot represented shall be rejected.

18. Rejected cylinders. (a) Repair of welded seams is authorized. Acceptable cylinders must pass all prescribed tests.

19. Marking. (a) Marking on each cylinder by stamping plainly and permanently on shoulder, top head, neck or valve protection collar which may be permanently attached to the cylinder and forming an integral part thereof, as follows:

(1) CTC-4E followed by the service pressure (for example, CCT-4E240).

(2) A serial number and an identifying symbol (letters); location of the number to be just below or immediately following the CTC mark; location of symbol to be just below or immediately following the number. The symbol and numbers must be those of purchaser user, or maker. The symbol must be registered with the Bureau of Explosives through the Canadian Transport Commission; duplications unauthorized.

Examples: CTC-4E240 1234 XY CTC-4E240-1234-XY

(3) Inspector's official mark, near serial number; date of test (such as 5-50 for May 1950), so placed that date of subsequent test can be easily added.

(4) Size of marks shall be at least ¼ inch high.

20. Inspector's report. (a) Required to be clear, legible, and in following form:

(Place)
(Date)

Gas Cyllinders
Manufactured for ..... Company
Location at .....
Manufactured by Company
Location at
Consigned to Company
Location at
Quantity .....
Size.....inches outside diameter by.. .inches long.

Marks stamped into the shoulder of the cylinder are:
Specification CTC .....
Serial numbers .....to . inclusive.
Inspector's mark .....
Identifying symbol (registered)
Test date .....
Tare weights (yes or no)
Other marks (if any)
These cylinders were made by process of. .

.....
The .....permitted in

(neckrings, footrings, etc.)

Paragraph 9 were attached by process of
The material used was identified by the following.....
numbers .....

The material used was verified as to chemical analysis and record thereof is attached hereto.

All material, such as aluminum plate, was inspected before manufacture and the drawn cylinder shells were inspected before final fabrication and found free from seams, cracks, lamination and other defects which might prove injurious to the strength of the cylinder; the processes of manufacture were found to be efficient and satisfactory.

The cylinder walls were measured and the minimum thickness noted was.....inch. The outside diameter was determined by a close approxamation to be..... inches. The wall stress was calculated to be.....pounds per square inch under an internal pressure of.....pounds per square inch.

Hydrostatic tests, flattening tests, tensile tests of material and other tests as prescribed in Specification CTC-4E were made in the presence of the inspector and all material and cylinders accepted were found to be in compliance with the requirements of that specification. Records thereof are attached hereto.

I hereby certify that all of these cylinders proved satisfactory in every way and comply with the requirements of Canada Transport Commission specification No. 4E except as follows:

Exceptions

(Signed)

Inspector.

(Place)
(Date)

RECORD OF CHEMICAL ANALYSIS OF MATERIAL OF CYLINDERS

Numbered . . . . . to . . . . . inclusive.
Size . . . . . inches outside diameter by . . . . . incles long.
Made by . . . . . Company
For . . . . . Company

NOTE: Any omission of analyses by heats, if authorized, must be accounted for by notation hereon reading "The prescribed certificate of the manufacturer of material has been secured, found satisfactory, and placed on file" or by attacking a copy of the certificate.

Test No.	Check analysis No.	Cylinders represented (Serial) Nos.)	Chemical Analysis							
			Mg	Cr	Cu	Mn	Zn	Ir	Al	Ti

The analyses were made by
(Signed)

(Place)
(Date)

RECORD OF PHYSICAL TESTS OF MATERIAL FOR CYLINDERS

Numbered . . . . . to . . . . . inclusive.
Size . . . . . inches outside diameter by . . . . . inches long.
Made by . . . . . Company
For . . . . . Company

Test No.	Cylinders represented by test (Serial Nos.)	Yield strength (pounds per square inch)	Tensile strength (pounds per square inch	Elongation (per cent in 8 inches)	Reduction of area (per cent)	Flattening test	Burst test (pounds per square inch)

(Signed)

(Place)
(Date)

RECORD OF HYDROSTATIC TESTS ON CYLINDERS

Numbered . . . . . to . . . . . inclusive.
Size . . . . . inches outside diameter by . . . . . inches long.
Made by . . . . . Company
For . . . . . Company

Serial numbers of cylinders tested arranged numerically	Actual test pressure (pounds per square inch)	Total expansion (cubic centimeters)[1]	Permanent expansion (cubic centimeters)[1]	Per cent ratio of permanent expansion to total expansion[1]	Tare weight (pounds)[2]	Volumetric capacity[3]

NOTE: When specification require test for only 1 out of each lot of 200 or less cylinders, the check on the others must be indicated by a notation hereon reading "Each cylinder was subjected to a pressure of . . . . . pounds per square inch and showed no defect."

[1] If the tests are made by a method involving the measurement of the amount of liquid forced into the cylinder by the test pressure, then the basic data, on which the calculations are made, such as the pump factors, temperature of liquid, coefficient of compressibility of liquid, etc., must also be given.

[2] Do not include removable cap but state whether with or without valve. These weights must be accurate to a tolerance of 1 per cent.

[3] Report approximate maximum and minimum volumetric capacity for the lot.

(Signed)

Specification 4L
WELDED CYLINDERS INSULATED

1. Compliance. (a) Required in all details.

2. Type, size, service pressure[1] and service temperature[2]. (a) Type and size. Must be fusion welded (not over 1000 pounds water capacity (nominal)). For liquefied hydrogen service, the cylinders must be designed to stand on end with the axis of the cylindrical portion vertical.

(b) The service pressure shall be more than 40 and not over 500 pounds per square inch.

(c) The service temperature shall be minus 320°F. or colder. For liquefied hydrogen service the service temperature shall be minus 423°F. or colder.

3. Inspection by whom and where. (a) By competent and independent inspector approved by the Canadian Transport Commission.

(b) Except as provided in paragraph (c) of this section, for cylinders not made in Canada the tests, as specified, shall be made within the limits of Canada unless written permission is obtained from the Commission to conduct the tests elsewhere.

(c) Notwithstanding paragraph (b) of this section cylinders made within the United States of America shall not be transported by rail in Canada unless they have been fabricated and tested in complete accordance with the applicable CTC or DOT Specification under the supervision of a representative from an independent inspection agency approved by the Commission.

4. Duties of inspector. (a) Inspect all material and reject any not complying with requirements of this specification.

(b) Verify chemical analysis of each heat of material by analysis or by obtaining certified analysis: **Provided,** That a certificate from the manufacturer thereof, giving sufficient data to indicate compliance with requirements, is acceptable when verified by check analyses of samples taken from one cylinder out of each lot of 200 or less.

(c) Verify compliance with all specification requirements. Obtain samples for all tests. Obtain samples for check chemical analyses, where required. Witness all tests. Report volumetric capacity, tare weight (see report form), and minimum thickness of wall noted.

(d) Render complete report required by this specification to cylinder maker, Canadian Transport Commission and upon request to the purchaser.

5. Material. (a) Designations and limiting chemical compositions of steel authorized by this specification shall be as shown in paragraph 21(a), Table I.

6. Identification of material. (a) Required; by any suitable method.

7. Defects. (a) Material with seams, cracks, laminations, or other injurious defects, not authorized.

[1] The "service pressure" limits the use of the cylinder. It is shown by marks on the cylinder; for example: CTC-4L200 indicates the service pressure as 200 pounds per square inch.

[2] The service temperature is the lowest temperature at which the cylinder may be used.

8. Manufacture. (a) By best appliances and methods; dirt and scale to be removed as necessary to afford proper inspection; no defect acceptable that is likely to weaken the finished cylinder appreciably; reasonably smooth and uniform surface finish required. The shell portion must be a reasonably true cylinder.

(b) The heads must be seamless, concave side to the pressure, hemispherical or ellipsoidal in shape with the major diameter not more than twice the minor diameter. Minimum thickness of heads shall be not less than 90 per cent of the required thickness of the sidewall. The heads must be reasonably true to shape, shall have no abrupt shape changes and the skirts must be reasonably true to round.

(c) The surface of the cylinder must be insulated. The insulating material must be fire resistant. The insulation must be covered with a steel jacket of not less than 0.060 inch thickness so constructed that moisture cannot come in contact with the insulating material. The construction must be such that the total heat transfer from the atmosphere at ambient temperature to the contents of the cylinder shall not exceed 0.0005 BTU per hour per degree F° differential in temperature per pound of water capacity of the cylinder. For liquefied hydrogen service, the total heat transfer, with a temperature difference of 520 Fahrenheit degrees, must not exceed that required to vent 30 standard cubic feet of hydrogen gas per hour.

9. Welding. (a) All seams of the cylinder must be fusion welded. Means must be provided for accomplishing complete penetration of the joint. Only butt or joggle butt joints for the cylinder seams are authorized. All joints in the cylinder must be in reasonably true alignment.

(b) All attachments to the sidewalls and heads of the cylinder must be by fusion welding and must be of a weldable material complying with the impact requirements of paragraph 17(d).

(c) For welding the cylinder, each procedure and operator shall be qualified in accordance with the sections that apply in CGA Pamphlet C-3. In addition, impact tests of the weld shall be performed in accordance with paragraph 17(d) as part of the qualification of each welding procedure and operator.

(d) Brazing, soldering and threading are permitted only for joints not made directly to the cylinder body. Threads must comply with paragraph 12.

10. Wall thickness. (a) The minimum wall thickness of the cylinder shall be such that the calculated wall stress at minimum required test pressure shall not exceed the least value of the following:

(1) 45,000 pounds per square inch.

(2) One-half of the minimum tensile strength across the welded seam determined as required in paragraph 17(a).

(3) One-half of the minimum tensile strength of the base metal determined as required in paragraph 15.

(4) The yield strength of the base metal determined as required in paragraph 15.

(5) Further provided that wall for cylinders having longitudinal seams must not exceed 85 per cent of the above value, whichever applies.

(b) Calculation must be made by the formula:

$$S = \frac{P\,(1.3D^2 + 0.4d^2)}{D^2 - d^2}$$

where:

S = wall stress in pounds per square inch;
P = minimum test pressure prescribed for hydrostatic test;
D = outside diameter in inches;
d = inside diameter in inches;

11. Heat treatment. Not permitted.

12. Openings in cylinder. (a) Openings permitted in heads only. They must be circular and shall not exceed 3 inches diameter or ⅓ of the cylinder diameter, whichever is the smaller. Each opening in the cylinder must be provided with a fitting, boss or pad securely attached to the cylinder body by fusion welding. Attachments to a fitting, boss or pad may be made by welding, brazing, soldering or threading. Threads must comply with the following:

(1) Threads must be clean cut, even, without checks and cut to gauge.

(2) Taper threads to be of length not less than as specified for American Standard taper pipe threads.

(3) Straight threads must have at least 4 engaged threads and have tight fit and calculated shear strength at least 10 times the test pressure of the cylinder; gaskets required, inert to the commodity and adequate to prevent leakage.

13. Safety devices and pressure control valves. (a) Must be as required by Canadian Transport Commission. Regulations that apply (§§ 73.34(d), and 73.304(b)(2)).

14. Pressure test. (a) Each cylinder before insulating and jacketing must be examined under a pressure of at least 2 times the service pressure, maintained for at least 30 seconds without evidence of leakage, visible distortion or other defect. Pressure gauge must permit reading to accuracy of 1 per cent.

15. Physical test. (a) Determining yield strength, tensile strength, and elongation on 2 specimens selected from material of each heat and in the same condition as that in the completed cylinder.

(b) Specimens must be: Gauge length 8 inches with width not over 1½ inches; or, gauge length 2 inches with width not over 1½ inches; or, gauge length at least 24 times thickness with width not over 6 times thickness (authorized when cylinder wall is not over 3/16 inch thick). The specimen, exclusive of grip ends, must not be flattened. Grip ends may be flattened to within one inch of each end of the reduced section. When size of cylinder does not permit securing straight specimens, the specimens may be taken in any location or direction and may be straightened or flattened cold, by pressure only, not by blows; when specimens are so taken and prepared, the inspector's report must show in connection with record of physical tests detailed information in regard to such specimens. Heating of specimen for any purpose is not authorized.

(c) The yield strength in tension shall be the stress corresponding to a permanent strain of 0.2 per cent of the gauge length.

(1) The yield strength shall be determined by either the "offset" method or the "extension under load" method as prescribed in ASTM Standard E8-57T.

(2) In using the "extension under load" method, the total strain (or "extension under load"), corresponding to the stress at which the 0.2 per cent permanent strain occurs may be determined with sufficient accuracy by calculating the elastic expansion of the gauge length under appropriate load and adding thereto 0.2 per cent of the gauge length. Elastic extension calculations shall be based on the elastic modulus of the material used. In the event of controversy, the entire stress-strain diagram shall be plotted and the yield strength determined from the 0.2 per cent offset.

(3) For the purpose of strain measurement, the initial strain reference shall be set while the specimen is under a stress of 12,000 pounds per square inch, the strain indicator reading being set at the calculated corresponding strain.

(4) Cross-head speed of the testing machine shall not exceed ⅛ inch per minute during yield strength determination.

16. Acceptable results for physical tests. Physical properties must meet the limits specified in 21(a), Table 1, for the particular steel in the annealed condition. The specimens must show at least 20 per cent elongation for 2-inch gauge length except that the percentage may be reduced numerically by 2 for each 7,500 pounds per square inch increment of tensile strength above 100,000 pounds per square inch to a maximum of 5 such increments. Yield strength and tensile strength must meet the requirements of 21(a), Table 1.

17. Tests of welds. (a) Tensile test. A specimen shall be cut from one cylinder of each lot of 200 or less, or welded test plate.[4] The specimen shall be taken across the major seam and shall be prepared and tested in accordance with and must meet the requirements of CGA Pamphlet C-3. Should this specimen fail to meet the requirements, specimens may be taken from two additional cylinders or welded test plates from the same lot and tested. If either of the latter specimens fail to meet the requirements, the entire lot represented shall be rejected.

(b) Guided bend test. A "root" bend test specimen shall be cut from the cylinder or welded test plate, used for the tensile test specified in paragraph 17(a) and from any other seam or equivalent welded test plate if the seam is welded by a procedure different from that used for the major seam. Specimens shall be taken across the particular seam being tested and shall be prepared and tested in accordance with and shall meet the requirements of CGA Pamphlet C-3.

(c) Alternate guided-bend test. This test may be used and shall be as required by Compressed Gas Association's CGA Pamphlet C-3. The specimen shall be bent until the elongation at the outer surface, adjacent to the root of the weld, between the lightly scribed page lines a to b, shall be at least 20 per cent, except that this percentage may be reduced for steels having a tensile strength in excess of 100,000 pounds per square inch, as provided in paragraph 16(a).

(d) Impact tests. One set of three impact test specimens (for each test) shall be prepared and tested for determining the impact properties of the deposited weld metal (1) as part of the qualification of the welding procedure, (2) as part of the qualification of the operators, (3) for each "heat" of welding rod or wire used, and (4) for each 1,000 feet of weld made with the same heat of welding rod or wire.

(1) All impact test specimens shall be of the Charpy type, keyhole or milled U-notch, and shall conform in all respects to Figure 3 of ASTM E-23-60T. Each set of impact specimens shall be taken across the weld and have the notch located in the weld metal. When the cylinder material thickness is 2.5 mm or thicker, impact specimens shall be cut from a cylinder or welded test plate used for the tensile or bend test specimens. The dimension along the axis of the notch shall be reduced to the largest possible of 10 mm, 7.5 mm, 5 mm or 2.5 mm, depending upon cylinder thickness. When the material in the cylinder or welded test plate is not of sufficient thickness to prepare 2.5 mm impact test specimens, 2.5 mm specimens shall be prepared from a welded test plate made from ⅛ inch thick material meeting the requirements specified in paragraph 21(a), Table I, and having a carbon analysis of .05 minimum, but not necessarily from one of the heats used in the lot of cylinders. The test piece shall be welded by the same welding procedure as used on the particular cylinder seam being qualified and shall be subjected to the same heat treatment.

(2) Impact test specimens shall be cooled to the design service temperature. The apparatus for testing the specimens must conform to the requirements of ASTM Standard E-23-60T. The test piece, as well as the handling tongs, shall be cooled for a length of time sufficient to reach the service temperature. The temperature of the cooling device shall be maintained within a range of plus or minus 3°F. The specimen shall be quickly transferred from the cooling device to the anvil of the testing machine and broken within a time lapse of not more than six seconds.

(3) The impact properties of each set of impact specimens shall be not less than the values in the following table:

Size of specimen	Minimum Impact value required for average of each set of three specimen (ft-lb)	Minimum impact value permitted on one specimen only of a set of three (ft-lb)
10 mm × 10 mm	15	10
10 mm × 7.5 mm	12.5	8.5
10 mm × 5 mm	10	7.0
10 mm × 2.5 mm	5	3.5

(4) When the average value of the three specimens equals or exceeds the minimum value permitted for a single specimen and the value for more than one specimen is below the required average value, or when the value for one specimen is below the minimum value permitted for a single specimen, a retest of three additional specimens shall be made. The value of each of these retest specimens shall equal or exceed the required average value. When an erratic result is caused by a defective specimen, or there is uncertainty in test procedure, a retest is authorized.

[4] The welded test plate shall be in the same condition and approximately the same thickness as the cylinder wall and shall be of material from one of the heats used in the lot of cylinders which it represents, except test plates for impact tests shall comply with paragraph 17(d)(1). The test plate shall be welded by the same welding procedure as used on the particular cylinder seam being qualified and shall be subject to the same heat treatment.

18. Radiographic examination. (a) The techniques and acceptability of radiographic inspection shall conform to the standards set forth in CGA Pamphlet C-3.

(b) Cylinders must be examined as follows:

(1) One finished longitudinal seam shall be selected at random from each lot of 100 or less successively produced and be radiographed throughout its entire length. Should the radiographic examination fail to meet the requirements of paragraph (a) of this section, two additional seams of the same lot shall be examined, and if either of these fail to meet the requirements, each cylinder may be examined as outlined above; only those passing are acceptable.

19. Rejected cylinders. Welds may be repaired by suitable methods of fusion welding; reheat treatment authorized; subsequent thereto, acceptable cylinders must pass all prescribed tests.

20. Marking. (a) Marking required by stamping plainly and permanently on shoulder or top head of jacket or on a permanently attached plate or head protective ring as follows:

(1) CTC-4L followed by the service pressure (for example, CTC-4L200).

(2) ST followed by service temperature (for example, ST-423 F) on cylinders having a service temperature below minus 320°F. only; location to be just below the C.T.C. mark.

(3) Serial number and identifying symbol; location of number to be just below or immediately following the service temperature or CTC mark; location of symbol to be just below or immediately following the number. The symbol and numbers must be those of purchaser, user, or maker. The symbol must be registered with the Bureau of Explosives through the Canadian Transport Commission; duplications unauthorized.

(4) Maximum weight of content (Max. Content 00 #) on cylinders having a service temperature below minus 320°F. only; location near symbol.

Examples:

Service temp. minus 320°F.	Service temp. below minus 320°F.
CTC-4L200	CTC-4L200
1234	ST-423F
XY	1234
	XY
	MAX. CONTENT 00#

(5) Inspector's official mark, date of test (such as 10-55 for October 1955), near serial number.

(6) Size of markings at least ¼ inch high if space permits.

(b) Except for serial number, all markings prescribed in paragraph (a) of this section must be duplicated on each cylinder by any suitable means.

21. Authorized steels. (a) Electric furnace steel of uniform quality. Chemical analysis must conform to ASTM A-240. Type 304 Stainless Steel. The following chemical analyses and physical properties are authorized:

TABLE I—AUTHORIZED MATERIALS

Designation	Chemical analysis—limits in per cent Stainless Steel Type 304
Carbon[1]	0.08 maximum
Manganese	2.00 maximum
Phosphorus	0.045 maximum
Sulphur	0.030 maximum
Silicon	1.00 maximum
Nickel	8.00 10.50
Chromium	18.00 20.00
Molybdenum	
Titanium	
Columbium	

	Physical properties (annealed)
Tensile strength, p.s.i. (minimum)	75,000
Yield strength, p.s.i. (minimum)	30,000
Elongation in 2-inch (minimum) (percent)	30.0
Elongation other permissible gauge lengths (percent)	15.0

[1] The carbon analysis must be reported to the nearest hundredth of 1 percent.

NOTE 1: A heat of steel made under the above specifications is acceptable, even though its check chemical analysis is slightly out of the specified range, if it is satisfactory in all other respects, provided the tolerances shown in the following table are not exceeded except as approved by the Commission.

CHECK ANALYSIS TOLERANCES

Elements	Limit or maximum of specified range, percent	Tolerance over the maximum limit or under the minimum limit
Carbon	to 0.030 inclusive	0.005
	Over 0.030 to 0.20, inclusive	0.01
Manganese	To 1.00, inclusive	0.04
	Over 1.00 to 3.00, inclusive	0.04
Phosphorus[1]	To 0.040, inclusive	0.005
	over 0.040 to 0.20, inclusive	0.010
Sulfur	To 0.040, inclusive	0.005
Silicon	To 1.00, inclusive	0.05
Chromium	Over 15.00 to 20.00, inclusive	0.20
Nickel	Over 5.00 to 10.00, inclusive	0.10
	Over 10.00 to 20.00, inclusive	0.15

[1] Rephosphorized steels not subject to check analysis for phosphorus.

22. Inspector's report. (a) Required to be clear, legible and in following form:

(Place) .....

(Date) .....

Steel gas cylinders

Manufactured for .....

Location at .....

Manufactured by .....

Location at .....

Consigned to .....

Location at .....

Quantity .....

Size ..... inches outside diameter by ..... inches long.

Cylinders were pressure tested at ..... pounds per square inch and found to be satisfactory.

Maximum and minimum weight .....

Maximum and minimum volumetric capacity .....

Marks stamped into the ..... of the cylinder are:
(Location of marking)

Specification CTC .....

Service temperature ..... minus ..... °F.

Maximum weight of contents ..... (pounds)

Serial numbers ..... to ..... inclusive.

Inspector's mark .....

Identifying symbol (registered) .....

Test date .....

Tare weights (yes or no) .....

Other marks .....

.....

.....

These cylinders were made by process of .....

.....

The material used was authorized by paragraph 21.

The material used was identified by the following ..... (heat-purchase order)

numbers .....

.....

The material used was verified as to chemical analysis and record thereof is attached hereto. The heat numbers ..... (were-were not)

marked on the material.

All material was inspected and all that was accepted was found free from seams, cracks, laminations and other injurious defects.

The compliance of cylinders with specification requirements was verified including markings, condition of inside, tests, threads, etc. All cylinders with defects which might prove injurious were rejected. The processes of manufacture and heat treatment were supervised and found to be efficient and satisfactory.

The cylinder walls were measured and the minimum thickness noted was ..... inch. The outside diameter was determined by a close approximation to be ..... inches. The wall stress was calculated to be ..... pounds per square inch under an internal pressure of ..... pounds per square inch.

Pressure tests, tensile tests of material, and other tests as prescribed in specification No. CTC-4L ..... were made in the presence of the inspector and all cylinders accepted were found to be in compliance with the requirements of that specification. Records thereof are attached hereto.

Each cylinder ..... been equipped with safety devices as follows: (has-has not)

.....

I hereby certify that all of these cylinders proved satisfactory in every way and comply with the requirements of Canadian Transport Commission specification No. 4L except as follows:

Exceptions .....

.....

..... (Manufacturer's name)

(Signed) ..... Inspector

By .....

(Place) .....

(Date) .....

RECORD OF CHEMICAL ANALYSIS OF MATERIAL FOR CYLINDERS

Numbered ..... to ..... inclusive.

Size ..... inches outside diameter by ..... inches long.

Made by ..... Company

For ..... Company

Test No.	Heat No.	Check analysis No.	Cylinders represented (serial) Nos.)	Chemical analysis										
				C	P	S	Si	Mn	Ni	Cr	Mo	Cu	Al	Zr

Steel was manufactured by ..... Company. The originals of the certified mill test reports are in the files of the manufacturer.

Note: Any ommission of analyses by heats, if authorised, must be accounted for by notation hereon reading. "The prescribed certificate of the manufacturer of material has been secured, found satisfactory, and placed on file," or by attaching a copy of the certificate.

Chemical analyses were made by

(Place)

(Date)

RECORD OF PHYSICAL TESTS OF MATERIAL FOR CYLINDERS

Numbered ..... to ..... inclusive.

Size ..... inches outside diameter by ..... Inches long.

Made by ..... Company

For ..... Company

Test No.	Cylinders represented by test (serial Nos.)	Yield strength (pounds per square inch)	Tensile strength (pounds per square inch)	Elongation (per cent) in inches)	Impact test results	Weld tensile test	Weld bend test

(Signed)

Specification 5
STEEL BARRELS OR DRUMS

Removable head containers which will pass all required tests are authorized.

1. Compliance. (a) Required in all details.

2. Rated capacity. (a) Rated capacity as marked, see sec. 11(a) (3). Actual capacity of straight-sided containers shall be not less than rated (marked) capacity plus 2 per cent, nor greater than rated capacity plus 2 per cent plus 1 quart, except that for containers over 25 gallons marked capacity actual capacity shall be not less than rated capacity plus 2 per cent, nor greater than rated capacity plus 2 per cent plus 2 quarts; actual capacity of bilge-type containers must be not less than rated capacity, nor greater than rated capacity plus 2 per cent plus 2 quarts.

3. Composition. (a) Sheets for body and heads to be low carbon, open hearth or electric steel. Stainless steel, when used, must be, except for rolling hoops and chime reinforcement, an austenitic 18 and 8 chrome nickel alloy with carbon content not over 0.08 per cent, or other equivalent grades.

5. Seams. (a) Body seams welded.

6. Chime reinforcement. (a) Containers over 21 gallons capacity, with flanged head secured to body, to have chime reinforcement adequate for its protection.

7. Parts and dimensions. (a) Parts and dimensions as follows:

Marked capacity not over (gallons)	Type of container	Minimum thickness, uncoated sheets (gauge)		Rolling hoops		
		Body sheet	Head sheet	Type[1]	Minimum Size (gauge or inch)	Minimum Weight (pounds per foot)
5	Straight side	22	22	None		
8½	do	20	20	do		
27½	do	14	14	do		
27½	do	18	18	U	16	
46	do	16	16	U[1]	14	
92	do	14	14	U[2]	12	
27½	do	18	18	I-bar	¾ × 1¼	1.25
46	do	16	16	I-bar[2]	¾ × 1¼	1.25
92	do	14	14	I-bar[3]	¾ × 1¼	1.25
27½	do	16	16	([3])		
46	do	14	14	([2]) ([3])		
27½	Bilge	14	16	None		
46	do	13	14	do		

[1] Rolling hoops of pliable solid rubber or other suitable material are also authorized when approved as to type and construction by the Bureau of Explosives or the Commission.

[2] Rolled or swedged-in hoops.

[3] In addition to the normal rolling hoops, the body of each removable head drum must have a rolled or swedged-in-hoop the centre-line of which shall be not more than 3 inches from the top curl.

(b) Steel sheets of specified gauges shall comply with the following:

Gauge No.	Nominal thickness[1] (inch)	Minimum thickness[1] (inch)
13	0.0897	0.0817
14	0.0747	0.0677
16	0.0598	0.0533
18	0.0478	0.0428
20	0.0359	0.0324
22	0.0299	0.0269

[1] Thickness shall be measured at any point on the sheet not less than ½ inch from an edge.

8. Rolling hoops. (a) Separate hoops to have tight fit on shell and be firmly secured in place. Beading under rolling hoops not permitted. Attachment to drum body by spot welding, except for continuous resistance method, not permitted. Welding of I-bar type directly to body of drum in any manner not permitted.

9. Closures. (a) Adequate to prevent leakage; gaskets required.

(b) Closing part (plug, cap, plate, etc., see Note 1) must be of metal as thick as prescribed for head of container; this not required for containers of 10 gallons or less when the opening to be closed is not over 2.7 inches in diameter. If unthreaded cap is used it must be provided with outside sealing devices which cannot be removed without destroying the cap or sealing device.

NOTE 1: This does not apply to cap seal over a closure which complies with all requirements.

(c) For closure with threaded plug or cap, the seat (flange, etc.) for plug, or cap, must have 3 or more complete threads; 2 drainage holes of not over 5/16 inch diameter are allowed. Plug, or cap, must have sufficient length of thread to engage 3 threads when screwed home with gasket in place.

(d) Full removable head drums over 5 gallons capacity must be closed by means of 12 gauge bolted ring with drop forged lugs, one of which is threaded, and having ⅜ inch bolt and nut for drums not over 25 gallons capacity and ⅝ inch bolt and nut for drums over 25 gallons capacity. Five gallon drums must be of lug type closure with cover having at least 16 lugs. Equally efficient types of closures are authorized upon demonstration and proof of satisfactory tests to representative of Bureau of Explosives, or the Commission.

10. Defective containers. (a) Leaks and other defects to be repaired by method used in constructing container, not by soldering.

11. Marking. (a) Marking on each container by embossing on head, except that such embossment must be on the permanent head for drums having removable heads, with raised marks, or by embossing or die stamping on footring on drums equipped with footrings, or on metal plates securely attached to drum by brazing or welding not less than 20 per cent of the perimeter, as follows:

(1) CTC-5. In addition, when the container is of stainless steel, the type of steel used in body and head sheets as identified by American Iron and Steel Institute type number, and also the letters HT following steel designation on containers subjected to stress relieving or heat treatment during manufacture, (for example, CTC-5-304 or CTC-5-304 HT as applicable), shall be shown. These marks shall be understood to certify that the container complies with all specification requirements.

(2) Name or symbol (letters) of maker; this must be recorded with the Bureau of Explosives through the Commission.

(3) Gauge of metal in thinnest part, rated capacity in gallons, and year of manufacture (for example, 14-46-50). When gauge of metal in body differs from that in head, both must be indicated with slanting line between and with gauge of body indicated first (for example 14/12-46-50 for body 14 gauge and head 12 gauge).

12. Size of markings. (a) Size of markings (minimum): ½″ high for 27½-gallon or less, ¾″ for over 27½ and not over 46 gallons, and 1″ for over 46 gallons.

13. Type tests. (a) Samples taken at random and closed as for use, shall withstand prescribed tests without leakage. Tests to be made of each type and size by each company starting production and to be repeated every four months. Samples last tested to be retained until further tests are made or for one year, whichever period is shorter. The type tests are as follows:

(1) Test by dropping, filled with water to 98 per cent capacity, from height of 4 feet on to solid concrete so as to strike diagonally on chime, or when without chime seam, to strike on other circumferential seam; also additional drop test on any other parts which might be considered weaker than the chime. Closing devices and other parts projecting beyond chime or rolling hoops must also be capable of withstanding this test.

(2) Hydrostatic pressure tests of 40 pounds per square inch sustained for 5 minutes; except that full removable head drums must sustain 20 pounds per square inch.

(3) Periodic drop and hydrostatic tests are not required when containers fabricated of stainless steel have satisfac-

torily withstood prescribed tests at the original start of production. Satisfactory test results must be obtained on samples of subsequent containers that have been altered in design or construction. In instances where manufacturers have suspended production for an interval of 12 months or more, drop and hydrostatic tests must be again conducted as prescribed in subparagraphs (1) and (2) as for original start of production. Samples last tested to be retained until further tests are made or for one year, whichever period is shorter.

14. Leakage test. (a) Each container shall be tested with seams under water or covered with soapsuds or heavy oil, by interior air pressure of at least 15 pounds per square inch. Equally efficient means of testing are authorized upon demonstration and proof of satisfactory tests to representative of Bureau of Explosives and the Commission. Leakers shall be rejected or repaired and retested. Removable head containers not required to be tested with heads in place except that samples taken at random and closed as for use, of each type and size, must be tested at start of production and repeated every four months. Samples last tested to be retained until further tests are made or for one year, whichever period is shorter.

Specification 5A
STEEL BARRELS OR DRUMS

Removable head containers not authorized.

1. Compliance. (a) Required in all details.

2. Rated capacity. (a) Rated capacity as marked, see sec. 11(a)(3). Actual capacity of straight-sided containers shall be not less than rated (marked) capacity plus 2 per cent, nor greater than rated capacity plus 2 per cent plus 1 quart, except that for containers over 25 gallons marked capacity actual capacity shall be not less than rated capacity plus 2 per cent, not greater than rated capacity plus 2 per cent plus 2 quarts: actual capacity of bilge-type containers must be not less than rated capacity, nor greater than rated capacity plus 2 per cent plus 2 quarts.

3. Composition. (a) Sheets for body and heads to be low carbon, open-hearth or electric steel.

5. Seams. (a) Body seams welded.

(b) Head and chime seams welded or double-seamed.

(c) Flanges for closures welded in place.

6. Chime reinforcements. (a) Containers over 21 gallons capacity, with flanged head secured to body, to have chime reinforcement adequate for its protection.

7. Parts and dimensions. (a) Parts and dimensions as follows:

Marked capacity not over (gallons)	Type of container	Minimum thickness in the black (gauge, United States standard)		Rolling hoops		
		Body sheet	Head sheet	Type[1]	Minimum Size (Gauge or inch)	Minimum Weight (pounds per foot)
8 1 2	Straight side ..	16	16	None ..	.....	.....
25	.. do ..	16	16	I-bar ...	3 4 x 1 1 4	1.25
46	.. do ..	14	14	.. do ...	1 x 1 1 2	1.60
92	.. do ..	12	12	.. do ...	1 x 1 1 2	1.60
25	Bilge ..	14	16	None ...	.....	.....
46	.. do ..	13	14	.. do ...	.....	.....

[1] Rolling hoops of pliable solid rubber or other suitable material are also authorized when approved as to type and construction by the Commission or the Bureau of Explosives.

(b) Steel sheets or specified gauges shall comply with the following:

Gauge No.	Nominal thickness[1] (inch)	Minimum thickness[1] (inch)
12	0.1046	0.0946
13	0.0897	0.0817
14	0.0747	0.0677
16	0.0598	0.0533

[1] Thickness shall be measured at any point on the sheet not less than 3 8 inch from an edge.

8. Rolling hoops. (a) Separate hoops to have tight fit on shell and be firmly secured in place. Beading under rolling hoops or welding of the rolling hoops directly to the body of the drum in any manner is not permitted.

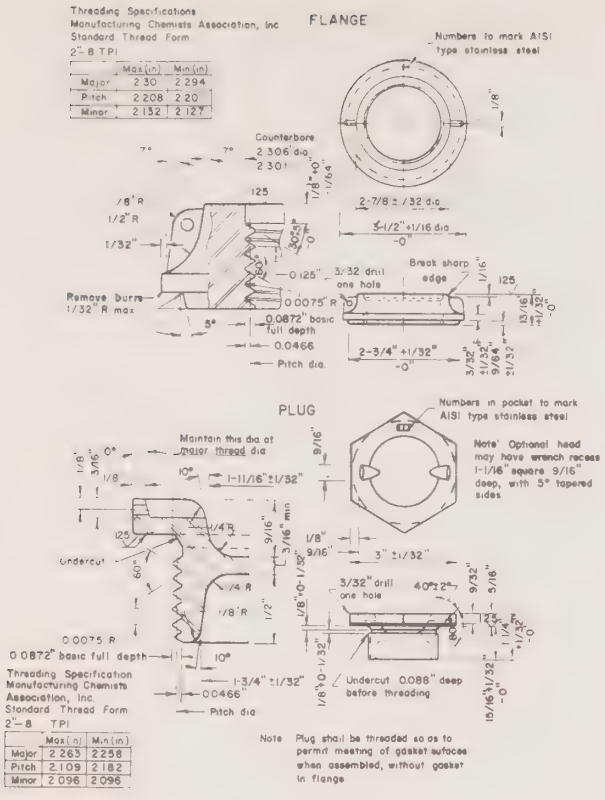
9. Closures. (a) Adequate to prevent leakage; gasket required. Closure must be of screw-thread type or fastened by screw-thread device. Unthreaded cap is authorized for containers of 10 gallons or less if cap is provided with outside sealing devices which cannot be removed without destroying the cap or sealing device.

(b) Closing part (plug, cap, plate, etc., see Note 1) must be of metal as thick as prescribed for head of container; this not required for containers of 10 gallons or less when the opening to be closed is not over 2.3 inches in diameter.

NOTE 1: This does not apply to cap seal over a closure which complies with all requirements.

(c) For closure with threaded plug or cap, the seat (flange, etc.) for plug, or cap, must have 3 or more complete threads; two drainage holes of not over 5/16-inch diameter are allowed. Plug, or cap, must have sufficient length of thread to engage 3 threads when screwed home with gasket in place.

(d) Openings over 2.3 inches diameter not permitted. Threads for plug or cap must be 8 or less per inch when over ¾ inch standard pipe size. Flanges with inside threads and plugs must conform with the thread diameter and thread form shown in the following drawing; other details shown on the drawing are recommended.



(e) Other threaded closures may be authorized by the Commission or Bureau of Explosives upon demonstration of equal efficiency.

10. Defective containers. (a) Leaks and other defects to be repaired by method used in constructing container, not by soldering.

11. Marking. (a) Marking on each container by embossing on head with raised marks, or by embossing or die stamping on footring on drums equipped with footrings, or on metal plates securely attached to drum by brazing or welding not less than 20 per cent of the perimeter as follows:

(1) CTC-5A. In addition, when the container is of stainless steel, the type of steel used in body and head sheets as identified by American Iron and Steel Instutute type number, and also the letters HT following steel designation on containers subjected to stress relieving or heat treatment during manufacture, (for example, CTC-5A-304 or CTC-5A-304 HT as applicable), shall be shown. These marks shall be understood to certify that the container complies with all specification requirements.

(2) Name or symbol (letters) of maker; this must be recorded with the Bureau of Explosives through the Commission.

(3) Gauge of metal in thinnest part, rated capacity in gallons, and year of manufacture (for example, 14-46-50). When gauge of metal in body differs from that in head, both must be indicated with slanting line between and with gauge of body indicated first (for example 14/12-46-50 for body 14 gauge and head 12 gauge).

12. Size of markings. (a) Size of markings (minimum): ½″ high for 27½-gallon or less, ¾″ for over 27½ and not over 46 gallons, and 1″ for over 46 gallons.

13. Type tests. (a) Samples taken at random and closed as for use, shall withstand prescribed tests without leakage. Tests to be made of each type and size by each company starting production and to be repeated every four months. Samples last tested to be retained until further tests are made or for one year whichever period is shorter. The type tests are as follows:

(1) Test by dropping, filled with water to 98 per cent capacity, from height of 6 feet on to solid concrete so as to strike diagonally on chime, or when without chime seam, to strike on other circumferential seam; also additional drop test on any other parts which might be considered weaker than the chime. Closing devices and other parts projecting beyong chime or rolling hoops must also be capable of withstanding this test.

(2) Hydrostatic pressure test of 80 pounds per square inch sustained for 5 minutes.

14. Leakage test. (a) Each container shall be tested, with seams under water or covered with soapsuds or heavy oil, by interior air pressure of at least 15 pounds per square inch. Equally efficient means of testing are authorized upon demonstration and proof of satisfactory tests to representative of the Commission or the Bureau of Explosives. Leakers shall be rejected or repaired and retested.

Specification 5B

STEEL BARRELS OR DRUMS

Removable head containers which will pass all required tests are authorized.

1. Compliance. (a) Required in all details.

2. Rated capacity. (a) Rated capacity as marked, see para. 11(a)(3). Minimum actual capacity of containers shall be not less than rated (marked) capacity plus 3.6 per cent. Maximum actual capacity shall not be greater than rated (marked) capacity plus 4.6 per cent or rated (marked) capacity plus 4 per cent plus 1 quart whichever is the greater. Actual capacity of bilge type containers must be not less than rated (marked) capacity, nor greater than rated (marked) capacity plus 2 per cent plus 2 quarts.

3. Composition. (a) Sheets for body and heads to be low carbon, open-hearth or electric steel.

5. Seams. (a) Body seams welded.

6. Chime Reinforcement. (a) Containers over 21 gallons capacity, with flanged head secured to body, to have chime reinforcement adequate for its protection.

7. Parts and dimensions. (a) Parts and dimensions as follows:

Marked capacity not over (gallons)	Type of container	Minimum thickness, uncoated sheets (gauge)		Rolling hoops		
		Body sheet	Head sheet	Type[1]	Minimum Size (Gauge or inch)	Minimum Weight (pounds per foot)
5	Straight side	24	24	None		
8 1 2	.. do	22	22	.. do		
12 1 2	.. do	20	20	(2)		
27 1 2	.. do	18	18	(2)		
46	.. do	16	16	(2)(3)		
91 1 2	.. do	13	14	(2)(3)		
27 1 2	Bilge	16	16	None		
46	.. do	14	14	.. do		

[1] Rolling hoops of pliable solid rubber or other suitable material are also authorized when approved as to type and construction by the Board or the Bureau of Explosives.

[2] Rolled or swedged-in hoops.

[3] Each removable head drum body must have three rolled or swedged in hoops with the centre-line of one not more than 3 inches from the top curl.

(b) Steel sheets of specified gauges shall comply with the following:

Gauge No.	Nominal thickness[1] (inch)	Minimum thickness[1] (inch)
13	0.0897	0.0817
14	0.0747	0.0677
16	0.0598	0.0533
18	0.0478	0.0428
20	0.0359	0.0324
22	0.0299	0.0269
24	0.0239	0.0209

[1] Thickness shall be measured at any point on the sheet not less than 3 8 inch from an edge.

8. Rolling hoops. (a) Separate hoops to have tight fit on shell and be firmly secured in place. Beading under rolling hoops or spot welding not permitted.

9. Closures. (a) Adequate to prevent leakage: gaskets required.

(b) Closing part (plug, cap, plate, etc., see Note I) must be of metal (see paragraph (c) of this section) as thick as prescribed for head of container; this not required for containers of 10 gallons or less when the opening to be closed is not over 2.7 inches in diameter. If unthreaded cap is used it must be provided with outside sealing devices which cannot be removed without destroying the cap or sealing device.

NOTE 1: This does not apply to cap seal over a closure which complies with all requirements.

(c) For closure with threaded plug or cap, the seat (flange, etc.) for plug, or cap, must have 3 or more complete threads; two drainage holes of not over 5/16 inch diameter are allowed. Plug, or cap, must have sufficient length of thread to engage 3 threads when screwed home with gasket in place. Closures of screw-thread type or closed by other positive means, of any material or design, may be authorized by the Commission or the Bureau of Explosives for use, upon satisfactory proof of efficiency.

(d) Full removable head drums over 5 gallons capacity must be closed by means of 12 gauge bolted ring with drop forged lugs, one of which is threaded, and have 3/8 inch bolt and nut for drums not over 25 gallons capacity and 5/8 inch bolt and nut for drums over 25 gallons capacity. Five gallon drums must be of lug type closure with cover having at least 16 lugs. Equally efficient types of closures are authorized upon demonstration and proof of satisfactory tests to representative of the Commission or the Bureau of Explosives.

10. Defective containers. (a) Leaks and other defects to be repaired by method used in constructing container, not by soldering.

11. Marking. (a) Marking on each container by embossing on head, except that such embossment must be on the permanent head for drums having removable heads, with raised marks, or by embossing or die stamping on footring on drums equipped with footrings, or on metal plates securely attached to drum by brazing or welding not less than 20 per cent of the perimeter, as follows:

(1) CTC-5B. In addition, when the container is of stainless steel, the type of steel used in body and head sheets as identified by American Iron and Steel Institute type number, and also the letter HT following steel designation on containers, subjected to stress relieving or heat treatment during manufacture, (for example, CTC-5B-304 or CTC-5B-304 HT as applicable), shall be shown. These marks shall be understood to certify that container complies with all specification requirements.

(2) Name or symbol (letters) of maker or other party assuming responsibility for compliance with specification requirements; this must be recorded with the Bureau of Explosives through the Commission.

(3) Gauge of metal in thinnest part, rated capacity in gallons, and year of manufacture (for example, 14-46-50). When gauge of metal in body differs from that in the head, both must be indicated with slanting line between and with

gauge of body indicated first (for example, 14/12-46-50 for body 14 gauge and head 12 gauge).

12. Size of markings. (a) Size of markings (minimum): ½″ high for 27½-gallon or less, ¾″ for over 27½ and not over 46 gallons, and 1″ for over 46 gallons.

13. Type tests. (a) Samples taken at random and closed as for use, shall withstand prescribed tests without leakage. Tests to be made of each type and size by each company starting production and to be repeated every four months. Samples last tested to be retained until further tests are made or for one year, whichever period is shorter. The type of tests are as follows:

(1) Test by dropping, filled with water to 98 per cent capacity, from height of 4 feet on to solid concrete so as to strike diagonally on chime, or when without chime seam, to strike on other circumferential seam; also additional drop test on any other parts which might be considered weaker than the chime. Closing devices and other parts projecting beyond chime or rolling hoops must also be capable of withstanding this test.

(2) Hydrostatic pressure test of 40 pounds per square inch sustained for 5 minutes; except that full removable head drums must sustain 20 pounds per square inch.

14. Leakage test. (a) Each container shall be tested, with seams under water or covered with soapsuds or heavy oil, by interior air pressure of at least 15 pounds per square inch. Equally efficient means of testing are authorized upon demonstration and proof of satisfactory tests to representative of the Commission or the Bureau of Explosives. Leakers shall be rejected or repaired and retested. Removable head containers not required to be tested with heads in place except that samples taken at random and closed as for use, of each type and size, must be tested at start of production and repeated every four months. Samples so tested must be retained until further tests are made or for one year, whichever period is shorter.

Specification 5C

STEEL BARRELS OR DRUMS

Removable head containers not authorized.

1. Compliance. (a) Required in all details.

2. Rated capacity. (a) Rated capacity as marked, see sec. 11(a)(3). Actual capacity of straight-sided containers shall be not less than rated (marked) capacity plus 2 per cent, nor greater than rated capacity plus 2 per cent plus 1 quart, except that for containers over 25 gallons marked capacity actual capacity shall be not less than rated capacity plus 2 per cent, nor greater than rated capacity plus 2 per cent plus 2 quarts; actual capacity of bilge-type containers must be not less than rated capacity, nor greater than rated capacity plus 2 per cent plus 2 quarts.

3. Composition. (a) Steel must be, except for rolling hoops and chime reinforcement, as follows:

(b) All sheet metal, welding rod, closing devices, and samples taken from the welded portion of the finished container must be of Type 304, 18 chrome 8 nickel alloy with 0.08 per cent carbon maximum, 18-20 per cent chromium, 8-11 per cent nickel, or other types of stainless steel of equivalent corrosion resistance and physical properties.

(c) Type 304 or other grades of equivalent corrosion resistant steels in the as-welded condition are permissible for nitric acid concentrations up to and including 78 per cent. For all concentrations of nitric acid the following are permissible:

(1) Type 304 heat-treated (quenches from 1900°F.), or

(2) Stabilized Type 347 in the as-welded condition, or

(3) Stabilized Type 347 stress-relieved (1550°-1650°F.), or

(4) Stabilized Type 347 heat-treated (quenches from 1900°F.), or

(5) Other grades of equivalent corrosion resistance.

(d) All parts of any completed container exposed to lading must comply with the standard 65 per cent boiling nitric acid test in that the limit of inches per month penetration in accordance with corrosion test as used in American Society of Testing Materials Standard A-262-44-T shall be 0.0015 inch, this figure to be an average of five 48-hour tests.

5. Seams. (a) Body seams welded.

(b) Chime seams welded or double-seamed and welded.

(c) Flanges for closures welded in place.

6. Chime reinforcement. (a) Containers of 8½ gallons capacity or over, with flanged head secured to body, to have chime reinforcement adequate for its protection.

7. Parts and dimensions. (a) Parts and dimensions as follows:

Marked capacity not over (gallons)	Type of container	Minimum thickness uncoated sheets (gauge)		Rolling hoops		
		Body sheet	Head sheet	Type[1]	Minimum Size (Gauge or inch)	Minimum Weight (pounds per foot)
12 1 2	Straight side	20	20	None		
25	.. do	18	18	I-bar	3 4 × 1 1 4	1 25
46	.. do	16	16	.. do[2]	1 × 1 1 2	1 60
92	.. do	14	14	.. do[2]	1 × 1 1 2	1 60
12 1 2	Bilge	16	16	None		
25	.. do	14	16	.. do		
46	.. do	13	14	.. do		

[1] Rolling hoops of pliable solid rubber or other suitable material are also authorised when approved as to type and construction by the Commission or Bureau of Explosives.

[2] Stainless steel I-bar rolling hoops 3/4 × 1 1 4 inch, weighing not less than 1.27 pounds per foot, are authorized.

(b) Steel sheets of specified gauges shall comply with the following:

Gauge No.	Nominal thickness[1] (inch)	Minimum thickness[1] (inch)
13	0.0897	0.0817
14	0.0747	0.0677
16	0.0598	0.0533
18	0.0478	0.0428
20	0.0359	0.0324

[1]Thickness shall be measured at any point on the sheet not less than 3/8 inch from an edge.

8. Rolling hoops. (a) Separate hoops to have tight fit on shell and be firmly secured in place. Beading under rolling hoops or spot welding not permitted.

9. Closures. (a) Adequate to prevent leakage; gaskets required. Closure must be of screw-thread type or fastened by screw-thread device. Unthreaded cap is authorized for containers of 10 gallons or less if cap is provided with outside sealing devices which cannot be removed without destroying the cap or sealing device.

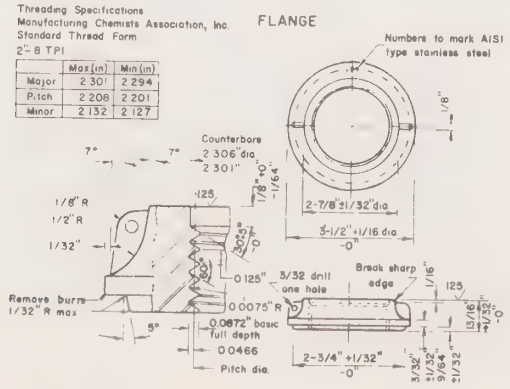
(b) Closing part (plug, cap, plate, etc, see Note 1) must be of metal as thick as prescribed for head of container; this not required for containers of 10 gallons or less when the opening to be closed is not over 2.3 inches in diameter.

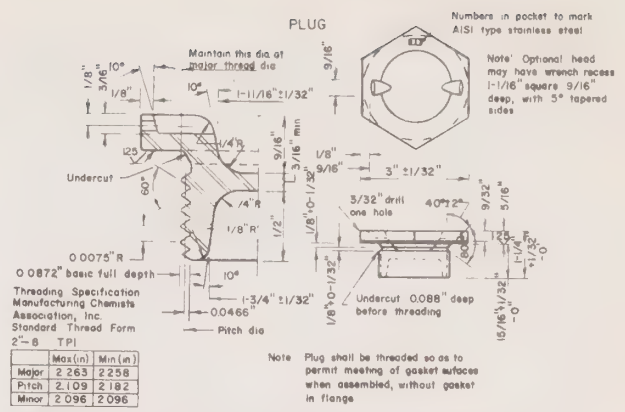
NOTE 1: This does not apply to cap seal over a closure which complies with all requirements.

(c) For closures with threaded plug or cap, the seat (flange, etc.) for plug, or cap, must have 5 or more complete threads; two drainage holes of not over 5/16-inch diameter are allowed. Plug, or cap, must have sufficient length of thread to engage 5 threads when screwed home with gasket in place. Except that for containers not over 12½ gallons marked capacity the seat (flanges, etc.) for plug or cap may have at least 3 complete threads and plug or cap sufficient length of thread to engage 3 threads when screwed home with gasket in place.

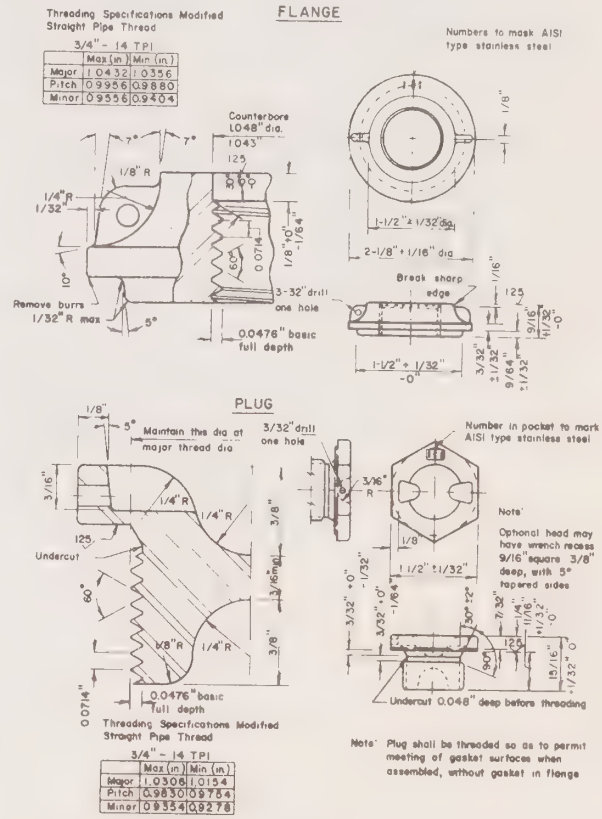
(d) Openings over 2.3 inches are not permitted. Threads for plug or cap must be 8 or less per inch when over ¾ inch standard pipe size.

(1) Flanges with inside threads and plug must conform with the thread diameter and thread form shown in the following drawing (other details shown on the drawing are recommended):





or **(2)** Eleven and one-half (11½) threads per inch, standard pipe size.



(e) Other threaded closures may be authorized by the Commission upon demonstration of equal efficiency.

10. Defective containers. (a) Leaks and other defects to be repaired by method used in constructing container, not by soldering.

11. Marking. (a) Marking on each container by embossing on head with raised marks, or by embossing or die stamping on footring on drums equipped with footrings, or on metal plates securely attached to drum by brazing or welding not less than 20 per cent of the perimeter as follows:

(1) CTC-5C, the type of steel used in body and head sheets as identified by American Iron and Steel Institute

type number, and, in addition, the letters HT following steel designation on containers subjected to stress relieving or heat treatment during manufacture (for example, CTC-5C-304 or CTC-5C-304HT as applicable). These marks shall be understood to certify that the container complies with all specification requirements.

(2) Name or symbol (letters) of maker; this must be recorded with the Bureau of Explosives through the Commission.

(3) Gauge of metal in thinnest part, rated capacity in gallons, and year of manufacture (for example, 14-46-50). When gauge of metal in body differs from that in head, both must be indicated with slanting line between and with gauge of body indicated first (for example, 14/12-46-50 for body 14 gauge and head 12 gauge).

12. Size of markings. (a) Size of markings (minimum): ½″ high for 27½-gallon or less, ¾″ for over 27½ and not over 46 gallons, and 1″ for over 46 gallons.

13. Type Tests. (a) Samples, taken at random and closed as for use, must be capable of withstanding prescribed tests without leakage. Tests to be made of each type and size by each company starting production and to be repeated every 4 months, except as provided in subparagraph (3) of this paragraph. Samples last tested to be retained until further tests are made or for one year, whichever period is shorter. The type tests are as follows:

(1) Test by dropping, filled with water to 98 per cent capacity, from height of 6 feet on to solid concrete so as to strike diagonally on chime, or when without chime seam, to strike on other circumferential seam; also additional drop test on any other parts which might be considered weaker than the chime. Closing devices and other parts projecting beyond chime or rolling hoops must also be capable of withstanding this test.

(2) Hydrostatic pressure test of 80 pounds per square inch sustained for 5 minutes.

(3) Periodic drop and hydrostatic tests are not required where container has satisfactorily met prescribed tests at the original start of production. Satisfactory test results must be obtained on samples of subsequent containers that have been altered in design or construction. Samples so tested must be retained until further tests are made or for one year, whichever period is shorter.

14. Leakage test. (a) Each container shall be tested, with seams under water or covered with soapsuds or heavy oil, by interior air pressure of at least 15 pounds per square inch. Equally efficient means of testing are authorized upon demonstration and proof of satisfactory tests to representative of the Commission or Bureau of Explosives. Leakers shall be rejected or repaired and retested.

Specification 5K

NICKEL BARRELS OR DRUMS

Removable head containers not authorized.

1. Compliance. (a) Required in all details.

2. Rated capacity. (a) Rated capacity as marked, see sec. 10(a)(3). Actual capacity of straight-sided containers shall be not less than rated (marked) capacity plus 2 per cent, nor greater than rated capacity plus 2 per cent plus 1 quart, except that for containers over 25 gallons marked capacity actual capacity shall be not less than rated capacity plus 2 per cent, nor greater than rated capacity plus 2 per cent plus 2 quarts; actual capacity of bilge-type containers must be not less than rated capacity, nor greater than rated capacity plus 2 per cent plus 2 quarts.

3. Composition. (a) Material must be, except for rolling hoops and chime reinforcements, nickel at least 99.0 per cent pure.

4. Seams. (a) Body seams welded.

(b) Head and chime seams welded or double-seamed.

(c) Flanges for closures welded in place.

5. Chime reinforcement. (a) Containers over 21 gallons capacity, with flanged head secured to body, to have chime reinforcement adequate for its protection.

6. Parts and dimensions. (a) Parts and dimensions as follows:

Marked capacity not over (gallons)	Type of container	Minimum thickness in the black (gauge, United States standard)		Rolling hoops		
		Body sheet	Head sheet	Type[1]	Minimum Size (Gauge or inch)	Minimum Weight (pounds per foot)
8 1 2	Straight side ..	16	16	None ..	.....	....
25	.. do	16	16	1-bar ...	3, 4 x 1 1 4	1 25
46	.. do	14	14	.. do ...	1 x 1 1 2	1 60
92	.. do	12	12	.. do ...	1 x 1 1 2	1 60
25	Bilge	14	16	None ..	.....	..... .
46	.. do	13	14	.. do ...	.....	.....

[1] Rolling hoops of pliable solid rubber or other suitable material are also authorized when approved as to type and construction by the Commission or the Bureau of Explosives.

7. Rolling hoops. (a) Separate hoops to have tight fit on shell and be firmly secured in place. Beading under rolling hoops or spot welding not permitted.

8. Closures. (a) Adequate to prevent leakage; gaskets required. Closure must be of screw-thread type or fastened by screw-thread device. Unthreaded cap is authorized for containers of 10 gallons or less if cap is provided with outside sealing devices which cannot be removed without destroying the cap or sealing device.

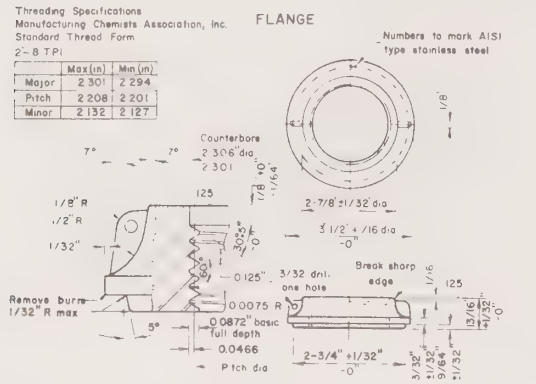
(b) Closing part (plug, cap, plate, etc., see Note 1) must be of metal as thick as prescribed for head of container; this not required for containers of 10 gallons or less when the opening to be closed is not over 2.3 inches in diameter.

NOTE 1: This does not apply to cap seal over a closure which complies with all requirements.

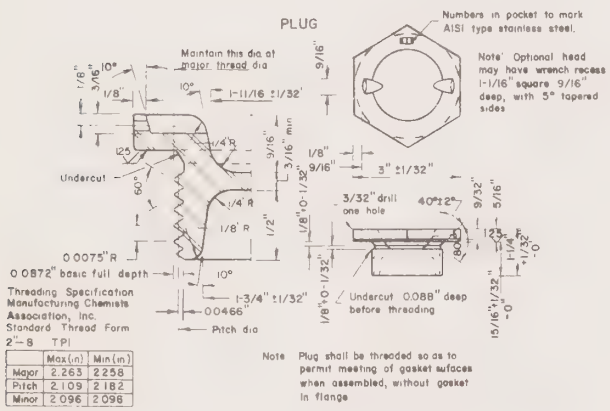
(c) For closure with threaded plug or cap, the seat (flange, etc.) for plug or cap must have 5 or more complete threads; 2 drainage holes of not over 5/16 inch diameter are allowed in that section of flange which extends inside the drum. Plug or cap must have sufficient length of thread to engage 5 threads when securely tightened with gasket in place.

(d) Openings over 2.3 inches in diameter are not permitted. Threads for plug or cap must be 8 or less per inch when over ¾ inch standard pipe size.

(1) Flanges with inside threads and plug must conform with the thread diameter and thread form shown in the following drawing (other details shown on the drawing are recommended):

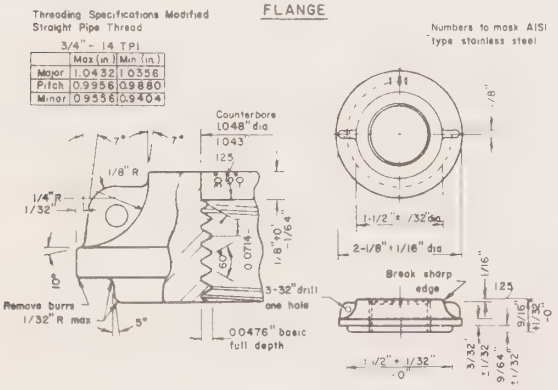


	Max (in)	Min (in)
Major	2.301	2.294
Pitch	2.208	2.201
Minor	2.132	2.127

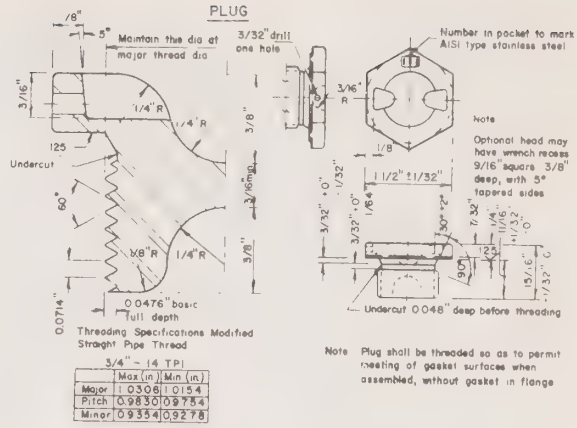


	Max (in)	Min (in)
Major	2.263	2.258
Pitch	2.109	2.182
Minor	2.096	2.096

or (2) Eleven and one-half (11½) threads per inch, standard pipe size.



	Max (in)	Min (in)
Major	1.0432	1.0356
Pitch	0.9956	0.9860
Minor	0.9536	0.9404



	Max (in)	Min (in)
Major	1.0306	1.0154
Pitch	0.9830	0.9734
Minor	0.9354	0.9278

(e) Other threaded closures may be authorized by the Bureau of Explosives upon demonstration of equal efficiency.

9. Defective containers. (a) Leaks and other defects to be repaired by method used in constructing container, not by soldering.

10. Marking. (a) Marking on each container by embossing on head with raised marks, or by embossing or die stamping on footring on drums equipped with footrings, or on metal plates securely attached to drum by brazing or welding not less than 20 per cent of the perimeter, as follows:

(1) CTC-5K. This mark shall be understood to certify that the container complies with all specification requirements.

(2) Name or symbol (letters) of maker; this must be recorded with the Bureau of Explosives through the Commission.

(3) Gauge of metal in thinnest part, rated capacity in gallons, and year of manufacture (for example, 14-46-50). When gauge of metal in body differs from that in head, both must be indicated with slanting line between and with gauge of body indicated first (for example, 14/12-46-50 for body 14 gauge and head 12 gauge).

11. Size of markings. (a) Size of markings (minimum): ½" high for 27½-gallon or less, ¾" for over 27½ and not over 46 gallons, and 1" for over 46 gallons.

12. Type tests. (a) Samples, taken at random and closed as for use must be capable of withstanding prescribed tests without leakage. Tests to be made of each type and size by each company starting production and to be repeated every 12 months, except as provided in subparagraph (8) of this paragraph. Samples last tested to be retained until further tests are made or for two years, whichever period is shorter. The type tests are as follows:

(1) Test by dropping, filled with water to 98 per cent capacity, from height of 6 feet onto solid concrete so as to strike diagonally on chime, or when without chime seam, to strike on other circumferential seam; also additional drop test on any other parts which might be considered weaker than the chime. Closing devices and other parts projecting beyond chime or rolling hoops must also be capable of withstanding this test.

(2) Hydrostatic pressure test of 80 pounds per square inch sustained for 5 minutes.

(3) Periodic drop and hydrostatic tests are not required where container has satisfactorily met prescribed tests at the original start of production. Satisfactory test results must be obtained on samples of subsequent containers that have been altered in design or construction. Samples so tested must be retained until further tests are made or for two years, whichever period is shorter.

13. Leakage test. (a) Each container shall be tested, with seams under water or covered with soapsuds or heavy oil, by interior air pressure of at least 15 pounds per square inch. Equally efficient means of testing are authorized upon demonstration and proof of satisfactory tests to representative of the Commission or the Bureau of Explosives. Leakers shall be rejected or repaired and retested.

Specification 5L

STEEL BARRELS OR DRUMS

Removable head containers not authorized.

1. Compliance. (a) Required in all details.

2. Rated capacity. (a) Rated capacity as marked, see sec. 9(a)(3). Actual capacity shall be not less than rated (marked) capacity plus 2 per cent, nor greater than rated capacity plus 2 per cent plus 1 quart.

3. Composition. (a) Sheets for body and heads to be low carbon, open-hearth or electric steel.

5. Seams. (a) Body seams welded.

(b) Head and chime seams welded or double-seamed.

(c) Flanged spout for filling and emptying container welded in place or attached in a manner approved by the Commission or the Bureau of Explosives.

6. Parts and dimensions. (a) Parts and dimensions as follows:

Marked capacity not over (gallons)	Type of container	Minimum thickness uncoated sheets (gauge)		Rolling hoops		
					Minimum	
		Body sheet	Head sheet	Type	Size (Gauge or inch)	Weight (pounds per foot)
5	Rectangular	20	20	Note .	.....	.....

(b) Steel sheets of specified gauges shall comply with the following:

Gauge No.	Nominal thickness[1] (inch)	Minimum thickness[1] (inch)
20	0.0359	0.0324

[1]Thickness shall be measured at any point on the sheet not less than 3/8 inch from an edge.

7. Closures. (a) Adequate to prevent leakage; gaskets required.

(b) Closing part must be of sufficient strength to withstand the drop test prescribed in sec. 11(a)(1).

(c) Closure must be of screw-thread type or fastened by screw-thread device.

(d) Openings over 2.5 inches diameter not permitted.

8. Defective containers. (a) Leaks and other defects to be repaired by method used in constructing container, not by soldering.

9. Marking. (a) Marking on each container by embossing on head with raised marks, or by embossing or die stamping on footring on drums equipped with footrings, or on metal plates securely attached to drum by brazing or welding not less than 20 per cent of the perimeter, as follows:

(1) CTC-5L. This mark shall be understood to certify that the container complies with all specification requirements.

(2) Name or symbol (letters) of maker; this must be recorded with the Bureau of Explosives through the Commission.

(3) Gauge of metal in thinnest part, rated capacity in gallons, and year of manufacture (for example, 20-5-50). When gauge of metal in body differs from that in head, both must be indicated with slanting line between and with gauge of body indicated first (for example, 20/18-5-50 for body 20 gauge and head 18 gauge).

10. Size of markings. (a) Size of markings (minimum): ½" high.

11. Type tests. (a) Samples taken at random and closed as for use, shall withstand prescribed tests without leakage. Tests to be made of each type and size by each company starting production and to be repeated every four months. Samples last tested to be retained until further tests are made or for one year, whichever period is shorter. The type tests are as follows:

(1) Test by dropping, filled with water to 98 per cent capacity, from height of 6 feet on to solid concrete so as to strike diagonally on chime, or when without chime seam, to strike on other circumferential seam; also additional drop test on any other parts which might be considered weaker than the chime. Closing devices and other parts projecting beyond chime or rolling hoops must also be capable of withstanding this test.

(2) Hydrostatic pressure test of 15 pounds per square inch sustained for 5 minutes.

12. Leakage test. (a) Each container shall be tested, with seams under water or covered with soapsuds or heavy oil, by interior air pressure of at least 5 pounds per square inch. Equally efficient means of testing are authorized upon demonstration and proof of satisfactory tests to representative of the Commission or the Bureau of Explosives. Leakers shall be rejected or repaired and retested.

Specification 5M

MONEL DRUMS

Removable head containers not authorized.

1. Compliance. (a) Required in all details.

2. Rated capacity. (a) Rated capacity as marked, see para. 10(a)(3). Actual capacity of containers shall be not less than rated (marked) capacity plus 2 per cent, nor greater than rated capacity plus 2 per cent plus 1 quart, except that for containers over 25 gallons marked capacity actual capacity shall be not less than rated capacity plus 2 per cent, nor greater than rated capacity plus 2 per cent plus 2 quarts.

3. Composition. (a) Material must be, except for rolling hoops and chime reinforcements, monel.

4. Seams. (a) Body seams welded.

(b) Head and chime seams welded or double-seamed.

(c) Flanges for closures welded in place.

5. Chime reinforcement. (a) Containers to have chime reinforcement adequate for its protection.

6. Parts and dimensions. (a) Parts and dimensions as follows:

Marked capacity not over (gallons)	Type of container	Minimum thickness in the black (gauge, United States standard)		Rolling hoops		
		Body sheet	Head sheet	Type[1]	Minimum Size (Gauge or inch)	Minimum Weight (pounds per foot)
8 1 2	Straight side ..	14	14	None ..	.....	.....
46	.. do	14	14	I-bar ...	1 x 1 1/2	1.60

[1] Rolling hoops of pliable solid rubber or other suitable material are also authorized when approved as to type and construction by the Commission or the Bureau of Explosives.

7. Rolling hoops. (a) Separate hoops if used, to have tight fit on shell and be firmly secured in place. Beading under rolling hoops or spot welding not permitted.

8. Closures. (a) Adequate to prevent leakage. Closure must be of screw-thread type or fastened by screw-thread device. Unthreaded cap is authorized for containers of 10 gallons or less if cap is provided with outside sealing devices which cannot be removed without destroying the cap or sealing device.

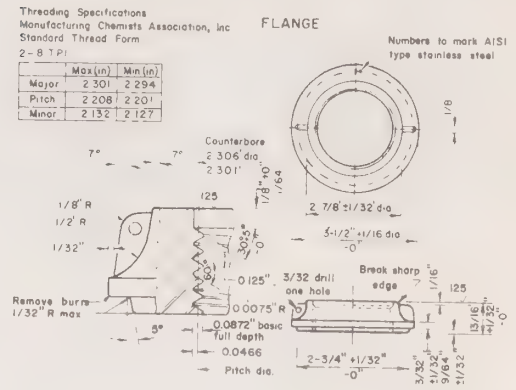
(b) Closing part (plug, cap, plate, etc., see Note 1) must be of metal as thick as prescribed for head of container; this not required for containers of 10 gallons or less when the opening to be closed is not over 2.3 inches in diameter.

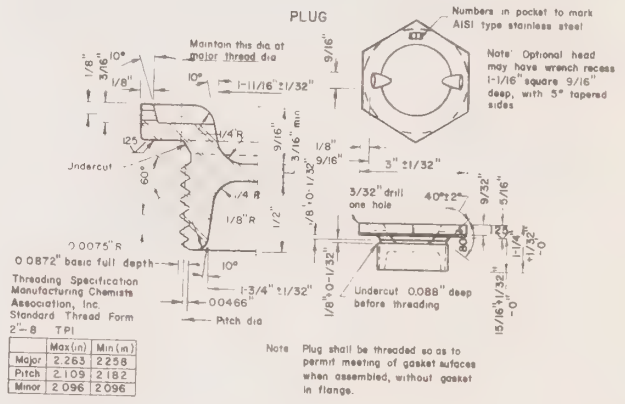
NOTE 1: This does not apply to cap seal over a closure which complies with all requirements.

(c) For closure with threaded plug or cap, the seat (flange, etc.) for plug or cap must have 5 or more complete threads; 2 drainage holes of not over 5/16 inch diameter are allowed in that section of flange which extends inside the drum. Plug or cap must have sufficient length of thread to engage 5 threads when securely tightened with gasket in place.

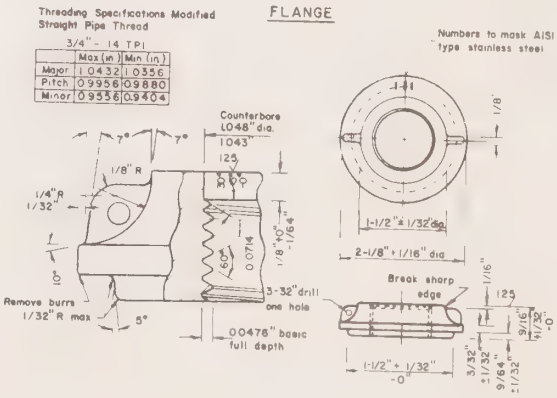
(d) Openings over 2.3 inches diameter are not permitted. Threads for plug or cap must be 8 or less per inch when over ¾ inch standard pipe size.

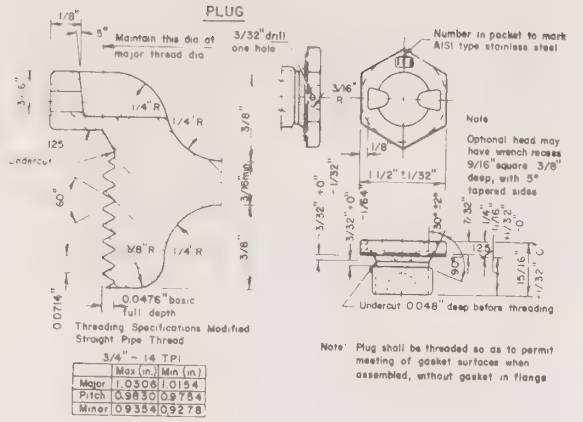
(1) Flanges with inside threads and plug must conform with the thread diameter and thread form shown in the following drawing (other details shown on the drawing are recommended):





or (2) Eleven and one-half (11½) threads per inch, standard pipe size.





(e) Other threaded closures may be authorized by the Commission or the Bureau of Explosives upon demonstration of equal efficiency.

9. Defective containers. (a) Leaks and other defects to be repaired by method used in constructing container, not by soldering.

10. Marking. (a) Marking on each container by embossing on head with raised marks, or by embossing or die stamping on footring on drums equipped with footrings, or on metal plates securely attached to drum by brazing or welding not less than 20 per cent of the perimeter, as follows:

(1) CTC-5M. This mark shall be understood to certify that the container complies with all specification requirements.

(2) Name or symbol (letters) of maker; this must be recorded with the Bureau of Explosives through the Commission.

(3) Gauge of metal in thinnest part, rated capacity in gallons, and year of manufacture (for example, 14-46-50).

11. Size of markings. (a) Size of markings (minimum): ½" high for 27½-gallon or less, ¾" for over 27½ and not over 46 gallons.

12. Type tests. (a) Samples, taken at random and closed as for use, must be capable of withstanding prescribed tests without leakage. Tests to be made of each type and size by each company starting production and to be repeated every 12 months, except as provided in subparagraph (3) of this paragraph. Samples last tested to be retained until further tests are made or for two years, whichever period is shorter. The type tests are as follows:

(1) Test by dropping, filled with water to 98 per cent capacity, from height of 6 feet onto solid concrete so as to strike diagonally on chime, or when without chime seam, to strike on other circumferential seam; also additional drop test on any other parts which might be considered weaker than the chime. Closing devices and other parts projecting beyond chime or rolling hoops must also be capable of withstanding this test.

(2) Hydrostatic pressure test of 80 pounds per square inch sustained for 5 minutes.

(3) Periodic drop and hydrostatic tests are not required where container has satisfactorily met prescribed tests at the original start of production. Satisfactory test results must be obtained on samples of subsequent containers that have been altered in design or construction. Samples so tested must be retained until further tests are made or for two years, whichever period is shorter.

13. Leakage test. (a) Each container shall be tested, with seams under water or covered with soapsuds or heavy oil, by interior air pressure of at least 15 pounds per square inch. Equally efficient means of testing are authorized upon demonstration and proof of satisfactory tests to representative of the Commission or Bureau of Explosives. Leakers shall be rejected or repaired and retested.

Specification 5P

LAGGED STEEL DRUMS

Removable head containers not authorized.

1. Compliance. (a) Required in all details.

2. Rated capacity. (a) Rated capacity not over 50 gallons, see sec. 12(a)(3). Actual capacity shall be not less than rated capacity plus two per cent nor greater than rated capacity plus two per cent plus one and one-half gallons.

3. Composition. (a) Sheets for body and heads of inside container to be low carbon or austenitic stainless, open hearth or electric steel. Sheets for body and heads of outside shell may be of any weldable steel suitable for the purpose.

5. Construction. (a) Container shall consist of a straight-sided inside steel drum which must be lagged with a suitable fire-resistant lagging material of such insulating properties and thickness that the drum charged with the commodity to be shipped will not rupture in a fire when it is equipped with safety devices as required by sec. 9. The entire insulation must be covered with a metal shell so constructed that moisture cannot come in contact with lagging.

(b) Brazing is not permitted.

(c) All seams of drum and shell must be fusion welded.

(d) Flanges or bosses for closures in the inner container must be fusion welded in place to the inside drum and the metal shell.

(e) Means for testing inside drum for leaks must be provided in outside shell.

6. Parts and dimensions. (a) Parts and dimensions as follows:

(1) Steel sheets used for body and head sheets for inside drum must have nominal thickness of at least 0.0747 inch and minimum thickness of 0.0677 inch, uncoated sheets, which shall be designated 14 gauge.

(2) Steel sheets used for body sheets for outside shell must have nominal thickness of at least 0.1046 inch and

minimum thickness of 0.0946 inch, uncoated sheets, which shall be designated 12 gauge.

(3) Steel sheets used for head sheets for outside shell must have nominal thickness of at least 0.0747 inch and minimum thickness of 0.0677 inch, uncoated sheets, which shall be designated 12 gauge.

7. Rolling hoops. (a) Rolling hoops are required and these may be rolled or swedged in the outside shell or consist of separate hoops having a tight fit on shell and securely held in place.

8. Closures. (a) All closures must be of screw-thread type adequate to prevent leakage and be of a material which will not react dangerously in contact with the commodity.

(b) All openings in inside drums must be located in the top head.

(c) Openings over 2.8 inches screw thread size not permitted.

(d) Plugs, caps, or other fittings must have sufficient length of thread to engage 5 threads when screwed home with gasket in place.

(e) Gaskets which are not affected by lading are required for closures having straight threads.

9. Safety Devices. (a) Each container must be provided with safety devices approved as to type and location by the Commission or the Bureau of Explosives and found to prevent the bursting of the normally charged container when it is placed in a fire. See sec. 73.124(a)(4).

10. Closure protection. (a) Construction must be such as to afford adequate protection to valves and safety devices.

11. Defective containers. (a) Leaks and other defects to be repaired only by processes used in constructing container.

12. Marking. (a) Marking on each container by embossing with raised marks or by steel stamping on top head of outside shell or on a permanently attached head protective ring, as follows:

(1) CTC-5P. This mark shall be understood to certify that the container complies with all specification requirements.

(2) Name or symbol (letters) of maker; this must be recorded with and its use approved by the Bureau of Explosives through the Commission.

(3) Minimum gauge of metal of inner container, rated capacity in gallons and year of manufacture must be indicated in the order named (for example, 14-50-50).

(4) Size of markings (minimum): ½ inch high for stamping, 1 inch high for embossing.

13. Tests. (a) Sample drums, taken at random and closed as for use, shall withstand prescribed tests without leakage, one test to be made of each design and size of drum by each company before starting production as follows:

(1) Test by dropping, filled with water to 98 per cent capacity, from height of 4 feet onto solid concrete so as to strike diagonally on chime (footring), or when without chime seam, to strike on other circumferential seam; also additional drop test on any other parts which might be considered weaker.

(2) Hydrostatic pressure test of 100 pounds per square inch sustained for five minutes. This test shall be applied to the finished inner container before lagging material and outer shell are assembled.

(3) Samples last tested to be retained until further tests are made.

14. Leakage test. (a) Each container shall be subjected to a pressure test of at least 125 pounds per square inch sustained for at least 30 seconds. Test shall be applied to inner container before lagging material or outer shell is assembled. Failures shall be rejected or repaired and retested.

NOTE 1: If air or other gas is the pressurizing medium, the test should be conducted in a pit or equivalent means of safeguarding personnel.

(b) Subsequent to the test specified in paragraph (a) each container shall be tested with seams under water or covered with soapsuds or other suitable material by interior air pressure of at least 75 pounds per square inch. Leakage test shall be applied to finished inner container before lagging or outer shell is assembled. Leakers shall be rejected or repaired and retested.

Specification 6B

STEEL BARRELS OR DRUMS

Removable head containers which will pass all required tests are authorized.

1. Compliance. (a) Required in all details.

2. Rated capacity. (a) Rated capacity as marked, see sec. 9(a)(3). Actual capacity of straight-sided containers shall be not less than rated (marked) capacity plus 2 per cent, nor greater than rated capacity plus 2 per cent plus 1 quart, except that for containers over 25 gallons marked capacity actual capacity shall be not less than rated capacity plus 2 per cent, nor greater than rated capacity plus 2 per cent plus 2 quarts; actual capacity of bilge-type containers must be not less than rated capacity, nor greater than rated capacity plus 2 per cent plus 2 quarts.

3. Composition. (a) Sheets for body and heads to be low carbon, open-hearth or electric steel.

5. Parts and dimensions. (a) Parts and dimensions as follows:

Marked capacity (gallons)	Authorized gross weight (pounds)	Type of container	Minimum thickness uncoated sheets (gauge)		Rolling hoops		
			Body sheet	Head sheet	Type	Minimum Size (gauge or inch)	Minimum Weight (pounds per foot)
4 to 8 1/2	160	Straight side	18	18	None		
4 to 25	480	do	16	16	[1]	14	
4 to 46	880	do	14	14	[1]	12	
4 to 25	480	do	16	16	Bar	3/4 x 1/4	1.25
4 to 46	880	do	14	14	do	3/4 x 1/4	1.25
4 to 92	1,760	do	12	12	do	1 x 1/2	1.60
4 to 27 1/2	480	Bilge	15	16	None		
4 to 46	880	do	13	14	do		

[1] Rolled or swedged-in hoops permitted

(b) Steel sheets of specified gauges shall comply with the following:

Gauge No.	Nominal thickness[1] (inch)	Minimum thickness[1] (inch)
[illegible]	0.1046	0.0946
[illegible]	0.0897	0.0817
[illegible]	0.0747	0.0677
[illegible]	0.0673	0.0603
[illegible]	0.0598	0.0533
[illegible]	0.0478	0.0428

[1] Thickness shall be measured at any point on the sheet not less than 3/8 inch from an edge

6. Rolling hoops. (a) Separate hoops to have tight fit on shell and be firmly secured in place. Beading under rolling hoops not permitted. Attachment to drum body by spot welding, except for continuous resistance method, not permitted. Welding of I-bar type directly to body of drum in any manner not permitted.

7. Closures. (a) Adequate to prevent leakage; gaskets required. Closures must be of screw-thread type or secured by positive fastening.

(b) Closing part (plug, cap, plate, etc., see Note 1) must be of metal as thick as prescribed for head of container; this not required for containers of 10 gallons or less when the opening to be closed is not over 2.3 inches in diameter. If unthreaded cap is used it must be provided with outside sealing devices which cannot be removed without destroying the cap or sealing device.

NOTE 1: This does not apply to cap seal over a closure which complies with all requirements.

8. Defective containers. (a) Leaks and other defects to be repaired by method used in constructing container, not by soldering.

9. Marking. (a) Marking on each container by embossing on head, except that such embossment must be on the permanent head for drums having removable heads, with raised marks, or by embossing or die stamping on footring on drums equipped with footrings, or on metal plates securely attached to drum by brazing or welding not less than 20 per cent of the perimeter, as follows:

(1) CTC-6B***: stars to be replaced by the authorized gross weight (for example, CTC-6B880, etc.). In addition, when the container is of stainless steel, the type of steel used in body and head sheets as identified by American Iron and Steel Institute type number, and also the letters HT following steel designation on containers subjected to stress relieving or heat treatment during manufacture, (for example, CTC-6B880-304 or CTC-6B880-304 HT as applicable), shall be shown. These marks shall be understood to certify that the container complies with all specification requirements.

(2) Name or symbol (letters) of maker; this must be recorded with the Bureau of Explosives through the Canadian Transport Commission.

(3) Gauge of metal in thinnest part, rated capacity in gallons, and year of manufacture (for example, 14-46-50). When gauge of metal in body differs from that in head, both must be indicated with slanting line between and with gauge of body indicated first (for example, 14/12-46-50 for body 14 gauge and head 12 gauge).

10. Size of markings. (a) Size of markings (minimum): ½" high for 27½-gallon or less, ¾" for over 27½ and not over 46 gallons, and 1" for over 46 gallons.

11. Type tests. (a) Samples taken at random and closed as for use, shall withstand prescribed tests without leakage. Tests to be made of each type and size by each company starting production and to be repeated every four months. Samples last tested to be retained until further tests are made or for one year, whichever period is shorter. The type tests are as follows:

(1) Test by dropping, filled with dry, finely powdered material to the authorized gross weight, from height of 4 feet onto solid concrete so as to strike diagonally on top chime, or when without chime seam, to strike on other circumferential seam; also additional drop test on any other parts which might be considered weaker than the chime. Closing devices and other parts projecting beyond chime or rolling hoops must also be capable of withstanding this test.

(2) Hydrostatic pressure test of 30 pounds per square inch sustained for 5 minutes. Leakage through closure shall not constitute failure.

12. Leakage test. (a) Each container shall be tested, with seams under water or covered with soapsuds or heavy oil, by interior air pressure of at least 15 pounds per square inch. Equally efficient means of testing are authorized upon demonstration and proof of satisfactory tests to representatives of the Commission or the bureau of Explosives. Leakers shall be rejected or repaired and retested. Removable head containers not required to be tested with heads in place except that samples taken at random and closed as for use, of each type and size, must be tested at start of production and repeated every four months. Samples so tested must be retained until further tests are made or for one year, whichever period is shorter.

Specification 6C

STEEL BARRELS OR DRUMS

Removable head containers which will pass all required tests are authorized.

1. Compliance. (a) Required in all details.

2. Rated capacity. (a) Rated capacity as marked, see sec. 9(a)(3). Actual capacity of straight-sided containers shall be not less than rated (marked) capacity plus 2 per cent, nor greater than rated capacity plus 2 per cent plus 1 quart, except that for containers over 25 gallons marked capacity actual capacity shall be not less than rated capacity plus 2 per cent, nor greater than rated capacity plus 2 per cent plus 2 quarts; actual capacity of bilge-type containers must be not less than rated capacity, nor greater than rated capacity plus 2 per cent plus 2 quarts.

3. Composition. (a) Sheets for body and heads to be low carbon, open-hearth or electric steel.

5. Parts and dimensions. (a) Parts and dimensions as follows:

Marked capacity (gallons)	Authorized gross weight (pounds)	Type Type of container	Minimum thickness uncoated sheets (gauge)		Rolling hoops		
			Body sheet	Head sheet	Type	Minimum Size (gauge or inch)	Minimum Weight (pounds per foot)
5	80	Straight side	22	22	None		
5 to 8 1/2	160	.. do	20	20	.. do		
5 to 25	480	.. do	18	18	U	16	
5 to 46	880	.. do	16	16	U	14	
5 to 92	1,760	.. do	14	14	U	12	
5 to 25	480	.. do	18	18	I-bar	3/4 x 1/4	1.25
5 to 46	880	.. do	16	16	.. do	3/4 x 1/4	.85
5 to 92	1,760	.. do	14	14	.. do	1 x 1/2	1.60
5 to 27 1/2	480	Bilge	16	18	None		
5 to 46	880	.. do	15	16	.. do		

(b) Steel sheets of specified gauges shall comply with the following:

Gauge No.	Nominal thickness[1] (inch)	Minimum thickness[1] (inch)
14	0.0747	0.0677
16	0.0673	0.0603
18	0.0598	0.0538
20	0.0478	0.0428
22	0.0359	0.0324
24	0.0299	0.0269

[1] Thickness shall be measured at any point on the sheet not less than 3/8 inch from an edge

6. Rolling hoops. (a) Separate hoops to have tight fit on shell and be firmly secured in place. Beading under rolling hoops not permitted. Attachment to drum body by spot welding, except for continuous resistance method, not permitted. Welding of I-bar type directly to body of drum in any manner not permitted.

7. Closures. (a) Adequate to prevent leakage; gaskets required. Closures must be of screw-thread type or secured by positive fastening.

(b) Closing part (plug, cap, plate, etc., see Note 1) must be of metal as thick as prescribed for head of container; this not required for containers of 10 gallons or less when the opening to be closed is not over 2.3 inches in diameter. If unthreaded cap is used it must be provided with outside sealing devices which cannot be removed without destroying the cap or sealing device.

NOTE 1: This does not apply to cap seal over a closure which complies with all requirements.

8. Defective containers. (a) Leaks and other defects to by repaired by method used in constructing container, not by soldering.

9. Marking. (a) Marking on each container by embossing on head, except that such embossment must be on the permanent head for drums having removable heads, with raised marks, or by embossing or die stamping on footring on drums equipped with footrings, or on metal plates securely attached to drum by brazing or welding not less than 20 per cent of the perimeter, as follows:

(1) CTC-6C***; stars to be replaced by the authorized gross weight (for example, CTC-6C880, etc.) In addition, when the container is of stainless steel, the type of steel used in body and head sheets as identified by American Iron and Steel Institute type number, and also the letters HT following steel designation on containers subjected to stress relieving or heat treatment during manufacture, (for example, CTC-6C880-304 or CTC-6C880-304 HT as applicable), shall be shown. These marks shall be understood to certify that the container complies with all specification requirements.

(2) Name or symbol (letters) of maker; this must be recorded with the Bureau of Explosives through the Canadian Transport Commission.

(3) Gauge of metal in thinnest part, rated capacity in gallons, and year of manufacture (for example, 14-46-50). When gauge of metal in body differs from that in head, both must be indicated with slanting line between and with gauge of body indicated first (for example, 14/12-46-50 for body 14 gauge and head 12 gauge).

10. Size of markings. (a) Size of markings (minimum): ½″ high for 27½-gallon or less ¾″ for over 27½ and not over 46 gallons, and 1″ for over 46 gallons.

11. Type tests. (a) Samples taken at random and closed as for use, shall withstand prescribed tests without leakage. Tests to be made of each type and size by each company starting production and to be repeated every four months. Samples last tested to be retained until further tests are made or for one year, whichever period is shorter. The type tests are as follows:

(1) Test by dropping, filled with dry, finely powdered material to the authorized gross weight, from height of 4 feet onto solid concrete so as to strike diagonally on top chime, or when without chime seam, to strike on other circumferential seam; also additional drop test on any other parts which might be considered weaker than the chime. Closing devices and other parts projecting beyond chime or rolling hoops must also be capable of withstanding this test.

(2) Hydrostatic pressure test of 30 pounds per square inch sustained for 5 minutes. Leakage through closure shall not constitute failure.

12. Leakage test. (a) Each container shall be tested, with seams under water or covered with soapsuds or heavy oil, by interior air pressure of at least 15 pounds per square inch. Equally efficient means of testing are authorized upon demonstration and proof of satisfactory tests to representative of the Commission or the Bureau of Explosives. Leakers shall be rejected or repaired and retested. Removable head containers not required to be tested with heads in place except that samples taken at random and closed as for use, of each type and size, must be tested at start of production and repeated every four months. Samples so tested must be retained until further tests are made or for one year, whichever period is shorter.

Specification 6D

Cylindrical steel overpack, straight sided, for inside plastic container.

1. Material requirements. (a) Sheets for body and heads to be low carbon, open hearth or electric steel.

2. Construction requirements. (a) Construction requirements are as follows:

Rated capacity of inside plastic container not over (gallons)	Minimum thickness, uncoated sheets (gauge)		Body seams	Rolling hoops	Top or bottom head	Closures, when full head is used (gaskets not required)
	Body sheet	Head sheet				
5	24	24	Welded	None required	Double seamed or welded	Lug or plain ring seal
12 1 2	20	20	Welded	Rolled or swedged	Double seamed or welded	Lug or plain ring seal
25	19	19	Welded	Rolled or swedged	Double seamed or welded	Bolted type ring closure, 18 gauge
46	18	18	Welded	Rolled or swedged, or I-Bars, 3 4" x 1 1 4"	Double seamed or welded	Bolted type ring closure, 16 gauge

(b) Steel sheets or parts of specified gauges shall comply with the following:

Gauge number	Nominal thickness (inch)[1]	Minimum thickness (inch)[1]
16	0.0508	0.0533
18	0.0478	0.0428
19	0.0418	0.0378
20	0.0359	0.0324
24	0.0239	0.0209

[1] Thickness shall be measured at any point on the sheet not less than 3 8 inch from an edge.

(c) Two holes not exceeding ¼ inch each are permitted diametrically opposite each other in the overpack body immediately above the double seam of the bottom chime or three holes not exceeding 3/16 inch in diameter on centers 120 degrees apart in the bottom head.

(1) Overpack interior shall be free of projections, burrs, or any edges that might cause damage to inside plastic container and shall be free of lubricants, oils, or any foreign matter.

(2) Top head may have not more than two holes of suitable size to provide for protruding closures.

(3) Overpack shall be constructed to provide a snug fit for inside plastic container.

3. Tests. (a) Steel overpack when assembled as for use, shall withstand the tests prescribed in specifications for inside plastic containers when authorized as combination packages in Part 73. The completed package must withstand these tests without producing a condition of the overpack that could result in potential damage to the inside container.

4. Markings. (a) Marking on each container by embossing on bottom head with raised marks with letters and figures not less than ½ inch high as follows:

(1) CTC-6D. These marks shall be understood to certify the steel container complies with all construction requirements of this specification.

(2) Name or symbol (letters) of maker; this must be recorded with the Bureau of Explosives through the Commission.

(3) Gauge of metal in thinnest part, rated capacity of inside container in gallons, and year of manufacture (for example, 18-46-62). When gauge of metal in body differs from that in either head, both must be indicated with slanting line between and with gauge of body indicated first (for example, 18/16-46-62 for body 18 gauge and head 16 gauge).

Specification 6J

STEEL BARRELS AND DRUMS

Removable head containers which will pass all required tests are authorized.

1. Compliance. (a) Required in all details.

2. Rated capacity. (a) Rated capacity as marked, see sec. 9(a)(3). Actual capacity of straight-sided containers shall be not less than rated (marked) capacity plus 2 per cent, nor greater than rated capacity plus 2 per cent plus 1 quart, except that for containers over 25 gallons marked capacity actual capacity shall be not less than rated capacity plus 2 per cent, nor greater than rated capacity plus 2 per cent plus 2 quarts; actual capacity of bilge-type containers must be not less than rated capacity, nor greater than rated capacity plus 2 per cent plus 2 quarts.

3. Composition. (a) Sheets for body and heads to be low carbon, open-hearth or electric steel.

5. Parts and dimensions. (a) Parts and dimensions as follows:

Marked capacity (gallons)	Authorized gross weight (pounds)	Type of container	Minimum thickness uncoated sheets (gauge)		Rolling hoops	
			Body sheet	Head sheet	Type	Minimum size (gauge or inch)
5 to 25	260	Straight side	19	19		
5 to 46	480	.. do	18	18		
5 to 46	880	.. do	16	16	I-bar	14
5 to 46	880	.. do	16	16	I-bar	3 4 x 1 1 4
5 to 27 1 2	480	Bilge	16	18	None	
5 to 46	880	.. do	15	16	.. do	

[1] Rolled or swedged-in hoops.

(b) Steel sheets of specified gauges shall comply with the following:

Gauge No.	Nominal thickness[1] (inch)	Minimum thickness[1] (inch)
15	0.0673	0.0603
16	0.0598	0.0533
18	0.0478	0.0428
19	0.0418	0.0378

[1] Thickness shall be measured at any point on the sheet not less than 3 8 inch from an edge.

6. Rolling hoops. (a) Separate hoops to have tight fit on shell and be firmly secured in place. Beading under rolling hoops not permitted. Attachment to drum body by spot welding, except for continuous resistance method, nor permitted. Welding of I-bar type directly to body of drum in any manner not permitted.

7. Closures. (a) Adequate to prevent leakage; gaskets required. Closures must be of screw-thread type or secured by positive fastening.

(b) Closing part (plug, cap, plate, etc., see Note 1) must be of metal as thick as prescribed for head of container; this not required for containers of 10 gallons or less when the opening to be closed is not over 2.3 inches in diameter. If unthreaded cap is used, it must be provided with outside sealing devices which cannot be removed without destroying the cap or sealing device.

NOTE 1: This does not apply to cap seal over a closure which complies with all requirements.

8. Defective containers. (a) Leaks and other defects to be repaired by method used in constructing container, not by soldering.

9. Marking. (a) Marking on each container by embossing on head, except that such embossment must be on the permanent head for drums having removable heads, with raised marks, or by embossing or die stamping on footring on drums equipped with footrings, or on metal plates securely attached to drum by brazing or welding not les than 20 per cent of the perimeter, as follows:

(1) CTC-6J***; stars to be replaced by the authorized gross weight (for example, CTC-6J880, etc.). In addition when the container is of stainless steel, the type of steel used in body and head sheets as identified by American Iron and Steel Institute type number, and also the letters HT following steel designation on containers subjected to stress relieving or heat treatment during manufacture, (for example, CTC-6J880-304 HT as applicable), shall be shown. These marks shall be understood to certify that the container complies with all specification requirements.

(2) Name or symbol (letters) of maker; this must be recorded with the Bureau of Explosives through the Canadian Transport Commission.

(3) Gauge of metal in thinnest part, rated capcity in gallons, and year of manufacture (for example 14-46-50). When gauge of metal in body differs from that in head, both must be indicated with slanting line between and with gauge of body indicated first (for example, 14/12-46-50 for body 14 gauge and head 12 gauge).

10. Size of markings. (a) Size of markings (minimum): ½″ high for 27½-gallon or less, ¾″ for over 27½ and not over 46 gallons.

11. Type tests. (a) Samples taken at random and closed as for use, shall withstand prescribed tests without leakage. Tests to be made of each type and size by each company starting production and to be repeated every four months. Samples last tested to be retained until further tests are made or for one year, whichever period is shorter. The type tests are as follows:

(1) Test by dropping, filled with dry, finely powdered material to the authorized gross weight, from height of 4 feet onto solid concrete so as to strike diagonally on top chime, or when without chime seam, to strike on other circumferential seam; also additional drop test on any other parts which might be considered weaker than the chime. Closing devices and other parts projecting beyond chime or rolling hoops must also be capable of withstanding this test.

Specification 8

STEEL CYLINDERS

With approved porous filling for acetylene.

1. Compliance. (a) Required in all details.

2. Type and service pressure—(a) Type. Seamless except that the following is authorized: Longitudinal seam if forge lap welded; attachment of heads by welding or by brazing by dipping process; welded circumferential body seam if cylinder has no longitudinal seam.

(b) Service pressure.[4] 250 pounds per square inch.

3. Inspection by whom and where. By competent and independent Inspector approved by the Canadian Transport Commission. For cylinders not made in Canada, or the United States of America, the tests, as specified shall be made within the limits of Canada, unless written permission is obtained from the Commission to conduct the tests elsewhere.

(b) Duties of shell inspector:

(1) Inspect all material and reject any not complying with requirements; for cylinders made by billet-piercing process, billets to be inspected after nick and cold break.

(2) Require certified chemical analyses of steel used, signed by manufacturer thereof; also verify by check analyses of samples taken from each heat or from 1 out of each lot of 200 or less plates, shells, or tubes used.

(3) Verify compliance of cylinder shells with all shell requirements; inspect inside before closing in both ends; verify heat treatment as proper; obtain all samples for all tests and for check analyses; witness all tests; verify threads by gauge; report volumetric capacity and minimum thickness of wall noted.

(4) Prepare report on manufacture of steel shells in form prescribed in sec. 20(a). Furnish one copy to manufacturer, and three copies to the company that is to complete the cylinders.

(c) Duties of inspector of completed cylinders. Determine porosity of filling and tare weights; verify compliance of marking with prescribed requirements; obtain necessary copies of steel shell reports prescribed in paragraph (b) of this section; render complete report required by this specification to cylinder maker, Canadian Transport Commission and upon request to the purchaser.

4. Steel. (a) Open-heart, electric or basic oxygen process steel of uniform quality. Content per cent for the following not over: carbon, 0.25; phosphorus, 0.045; sulphur, 0.050.

5. Identification of steel. (a) Required; any suitable method except that plates and billets for hot-drawn cylinders shall be marked with heat number.

6. Defects. (a) Material with seams, cracks, laminations, or other injurious defects, not authorized.

7. Manufacture. (a) By best appliances and methods; dirt and scale to be removed as necessary to afford proper inspection; no defect acceptable that is likely to weaken the

[4] "Service pressure" limits the use of the cylinder to 250 pounds per square inch at 70°F.

finished cylinder appreciably; reasonably smooth and uniform surface finish required.

8. Exposed bottom welds. (a) Exposed bottom welds on cylinders over 18″ long must be protected by footrings.

9. Heat treatment. (a) Body and heads formed by drawing or pressing must be uniformly and properly heat treated prior to tests.

10. Openings. (a) Standard taper pipe threads required; length not less than as specified for American Standard pipe threads; tapped to gauge; clean cut, even and without checks.

11. Safety devices and protection for valves, safety devices, and other connections. (a) If applied must be as required by the Canadian Transport Commission regulations that apply. (See §§ 73.34(d) and 73.301(g)).

12. Hydrostatic test. (a) By water-jacket, or other suitable method, operated so as to obtain accurate data. Pressure gauge must permit reading to accuracy of 1 per cent. Expansion gauge must permit reading of total expansion to accuracy either of 1 per cent or 0.1 cubic centimetre.

(b) Pressure must be maintained for 30 seconds and sufficiently longer to insure complete expansion. Any internal pressure applied after heat-treatment and previous to the official test must not exceed 90 per cent of the test pressure.

(c) Permanent volumetric expansion must not exceed 10 per cent of total volumetric expansion at test pressure.

(d) One cylinder out of each lot of 200 or less must be hydrostatically tested to at least 750 pounds per square inch. Cylinders not so tested must be examined under pressure of between 500 and 600 pounds per square inch and show no defect. If hydrostatically tested cylinder fails, each cylinder in the lot may be hydrostatically tested and those passing are acceptable.

13. Leakage test. (a) By interior air or gas pressure not less than the service pressure; leakers must be rejected. Required only for cylinders with bottoms closed in by spinning.

14. Physical test. (a) Required on 2 specimens cut longitudinally from 1 cylinder or part thereof taken at random out of each lot of 200 or less, after heat treatment.

(b) Specimens must be: Gauge length 8″ with width not over 1½″; or, gauge length 2″ with width not over 1½″. Provided, that gauge length at least 24 times thickness with width not over 6 times thickness is authorized when cylinder wall is not over 3/16″ thick.

(c) The yield strength in tension shall be the stress corresponding to a permanent strain of 0.2 per cent of the gauge length.

(1) The yield strength shall be determined by either the "offset" method or the "extension under load" method as prescribed in ASTM Standard E8-57T.

(2) In using the "extension under load" method, the total strain (or "extension under load") corresponding to the stress at which the 0.2 per cent permanent strain occurs may be determined with sufficient accuracy by calculating the elastic extension of the gauge length under appropriate load and adding thereto 0.2 per cent of the gauge length. Elastic extension calculations shall be based on an elastic modulus of 30,000,000. In the event of controversy, the entire stress-strain diagram shall be plotted and the yield strength determined from the 0.2 offset.

(3) For the purpose of strain measurement, the initial strain shall be set while the specimen is under a stress of 12,000 pounds per square inch. the strain indicator reading being set at the calculated corresponding strain.

(4) Cross-head speed of the testing machine shall not exceed ⅛ inch per minute during yield strength determination.

(d) Yield strength shall not exceed 73 per cent of tensile strength. Elongation must be at least 40 per cent in 2 inches or 20 per cent in other cases.

15. Rejected cylinders. (a) Reheat treatment authorized; subsequent thereto, acceptable cylinders must pass all prescribed tests. Repair by welding is authorized.

16. Porous filling. (a) Cylinders must be filled with an approved porous material of such structure that it will not disintegrate or sag when wet with solvent or when subjected to normal service. The porous filling material shall be uniform in quality and free of voids, except that a well drilled into the filling material beneath the valve is authorized, provided that such a well be filled with a material of such type that the functions of the filling material are not impaired. Overall shrinkage of the filling material is authorized, provided the total clearance between the cylinder shell and filling material, after solvent has been added, does not exceed ½ of 1 per cent of the respective diameter or length but in no case to exceed ½ inch measured diametrically and longitudinally and that such clearances do not impair the functions of the filling material. In all cases, the filling material as installed in the cylinder must be approved by the Commission or the Bureau of Explosives.

(b) Porosity of filling to be 80 per cent or less except that filling with a porosity in excess of 80 per cent but not in excess of 92 per cent, may be used when tested with satisfactory results under the supervision of the Bureau of Explosives. When the porous mass has a porosity in excess of 80 per cent but not in excess of 83 per cent, the pores shall be uniform and shall not be visible at a magnification of 200 diameters. When the porous mass has a porosity in excess of 83 per cent but not in excess of 92 per cent, the pores shall be uniform and shall not be visible at a magnification of 500 diameters. A cylinder taken at random from a lot of 200 or less must be tested for porosity providing the porosity of each cylinder is not known. Should test cylinders fail, test of each cylinder of the lot is authorized, cylinders passing the test to be acceptable.

(c) For filling that is moulded and dried before insertion in cylinders, porosity test may be made on sample block taken at random from material to be used.

(d) The porosity of the filling material shall be determined; the amount of solvent at 70°F. for a cylinder:

(1) Having shell volumetric capacity above 20 pounds water capacity (nominal), shall not exceed the following:

Per cent porosity of filler:	Maximum acetone solvent per cent shell capacity by volume
90 to 92	43.4
87 to 90	42.0
83 to 87	40.0
80 to 83	38.6
75 to 80	36.2
70 to 75	33.8
65 to 70	31.4

(2) Having volumetric capacity of 20 pounds or less water capacity (nominal), shall not exceed the following:

Per cent porosity of filler:	Maximum acetone solvent per cent shell capacity by volume
90 to 92	41.3
83 to 90	38.5
80 to 83	37.1
75 to 80	34.8
70 to 75	32.5
65 to 70	30.2

17. Tare weight. (a) Tare weight referred to in secs. 1 to 21 shall be the combined weight of cylinder proper, porous filling, valve, and solvent, but without removable cap.

18. Marking. (a) Marking on each cylinder by stamping plainly and permanently on or near the shoulder, top head neck or valve protection collar which is permanently attached to the cylinder and forming an integral part thereof, as follows:

(1) CTC-8

(2) A serial number and an identifying symbol (letters); grouped[1] above, below, or immediately following the CTC mark. The symbol and numbers must be those of purchaser, user, or maker. The symbol must be registered with the Bureau of Explosives through the Canadian Transport Commission; duplications unauthorized.

Examples: CTC-8 / 1234 / XY CTC-8-1234-XY

(3) Date of test (such as 5-50 for May 1950), so placed that dates of subsequent tests can be easily added.

(4) Tare weight of cylinder in pounds and ounces.

(5) Cylinders, not completed, when delivered must each be marked for identification of each lot of 200 or less.

19. Size of marks. (a) At least 1/8″ high for cylinders less than 4″ inside diameter and at least ¼" high for larger cylinders.

20. Inspector's report. (a) Report to cover manufacturer of acetylene shells; required to be clear, legible, and in the following form:

(Place) .....

(Date) .....

Acetylene shells

Manufactured for ..... Company

Location at .....

Manufactured by ..... Company

Location at .....

Consigned to ..... Company

Location at .....

Quantity .....

Size ..... inches outside diameter by ..... inches long

Marks stamped into the shoulder of the cylinder are:

Lot number .....

Other marks (if any) .....

These cylinders were made by process of .....

.....

.....

.....

The material used was identified by the following ..... numbers
(heat-purchase order)

.....

The material used was verified as to chemical analysis and record thereof is attached hereto. The heat numbers .....
(were were not)

marked on the material.

All material, such as plates, billets and seamless tubing, was inspected and each cylinder was inspected both before and after closing in the ends; all that was accepted was found free from seams, cracks, laminations, and other defects which might prove injurious to the strength of the cylinder. The processes of manufacture and heat treatment of cylinders were supervised and found to be efficient and satisfactory.

The cylinder walls were measured and the minimum thickness noted was ..... inch. The outside diameter was determined by a close approximation to be ..... inches. The wall stress was calculated to be ..... pounds per square inch under an internal pressure of ..... pounds per square inch.

Hydrostatic tests, flattening tests, tensile tests of material, and other tests, as prescribed in specification No. CTC-8 were made in the presence of the inspector and all material and cylinders accepted were found to be in compliance with the requirements of that specification. Records thereof are attached hereto.

I hereby certify that all of these cylinders proved satisfactory in every way and comply with the requirements of the Canadian Transport Commission specification No. 8 except as follows:

Exceptions .....

.....

.....

(Signed) .....
Inspector

(Place) .....

(Date) .....

RECORD OF CHEMICAL ANALYSIS OF MATERIAL FOR CYLINDERS

Numbered ..... to ..... inclusive.

Size ..... inches outside diameter by ..... inches long.

Made by ..... Company

For ..... Company

NOTE: Any omission of analyses by heats, if authorized, must be accounted for by notation hereon reading "The prescribed certificate of the manufacturer of material has been secured, found satisfactory, and placed on file," or by attaching a copy of the certificate.

Test No.	Heat No.	Check analysis No.	Cylinders represented (serial Nos.)	Chemical analysis						
				C	P	S	Si	Mn	Ni	Cr

The analyses were made by

(Signed)

[1] Variation in location authorized only when necessitated by lack of space.

(Place)

(Date)

RECORD OF PHYSICAL TESTS OF MATERIAL FOR CYLINDERS

Numbered ..... to ..... inclusive.

Size ..... inches outside diameter by ..... inches long.

Made by ..... Company

For ..... Company

Test No.	Cylinders represented by test (serial Nos.)	Yield strength (pounds per square inch)	Tensile strength (pounds per square inch)	Elongation (per cent in 8 inches)	Reduction of area (per cent)	Flattening test

(Signed)

(Place)

(Date) .....

RECORD OF HYDROSTATIC TESTS ON CYLINDERS

Numbered ..... to. ..... inclusive.

Size ..... inches outside diameter ..... inches long.

Made by ..... Company

For ..... Company

Serial Nos. of cylinders tested arranged numerically	Actual test pressure (pounds per square inch)	Total expansion (cubic centimetres)[1]	Permanent expansion (cubic centimetres)[1]	Per cent ratio of permanent expansion to total expansion[2]	Volumetric capacity[1]

NOTE: When specification requires test for only 1 out of each lot of 200 or less cylinders, the check on the others must be indicated by a notation hereon reading, "Each cylinder was subjected to a pressure of ..... pounds per square inch and showed no defect".

[1] If the tests are made by a method involving the measurement of the amount of liquid forced into the cylinder by the test pressure then the basic data, on which the calculations are made, such as the pump factors, temperature of liquid, coefficient of compressibility of liquid, etc., must also be given.

[2] Report approximate maximum and minimum volumetric capacity for the lot.

(Signed)

(b) Inspector's report to cover complete manufacture of acetylene cylinders; required to be clear and legible and in the following form:

(Place) ..
(Date)

Final Report; For completed steel cylinders with approved porous filling for acetylene.
Manufactured for
Location at
Steel shells manufactured by
Location at
Cylinders completed by
Location at
Consigned to
Location at
Quantity .....
Size ..... inches outside diameter by ..... inches long.
Marks stamped into ..... as follows:
(show location)
Specification CTC-8.
Serial numbers ..... to ..... inclusive.
Identifying symbol (registered)
Inspector's mark (if applied)
Test date
Other marks (if any) .

Application of prescribed marks, as reported above, and location thereof were verified.

Each cylinder was filled with porous filling material consisting of ..... in the form of .....

The porosity of the filling is between ..... and ..... per cent as determined by test made by the ..... company whose report has been found satisfactory and is on file.

The tare weight of each cylinder was determined and a record thereof is attached hereto.

Each cylinder has been equipped with safety devices

A certified report of manufacture and test of the steel shells is attached hereto.

I hereby certify that, subject to the acceptability of the reports covering the steel shells, all of these cylinders proved satisfactory in every way and comply with the requirements of the Canadian Transport Commission Specification No. 8.

(Signed)

Inspector

21. Additional type. (a) For seamless cylinders, contracted for by the Dept. of National Defence, made of steel commercially known as 4130X the prescribed limitations of carbon content, yield point, and elongation of steel are hereby waived provided the cylinders otherwise comply with paras. 1 to 20 and the following conditions:

(b) The following chemical analysis is authorized. (See Note 1.)

Designation	4130× (per cent)
Carbon	0.25/0.35
Manganese	0.40/0.90
Phosphorus	0.04 max.
Sulphur	0.05 max.
Silicon	0.20/0.35
Chromium	0.80/1.10
Molybdenum	0.15/0.25
Zirconium	
Nickel	

NOTE 1: A heat of steel made under the above specification, check chemical analysis of which is slightly out of the specified range, is acceptable, if satisfactory in all other respects, provided the tolerances published by the American Iron and Steel Institute in Table 6-4 of "Supplementary Information July 1958, "Toy Steel: Semi-finished, Hot Rolled and Cold Finished Bars, July 1955," are not exceeded; or provided the variation in chemical analysis is approved by the Commission or Bureau of Explosives.

(c) Minimum wall thickness must be such that the wall stress under interior pressure of 1,000 pounds per square inch will not exceed 18,000 pounds per square inch when calculated by the formula:

$$S = \frac{P\,(1.3D^2 + 0.4d^2)}{D^2 - d^2}$$

where:

S = wall stress in pounds per square inch;
P = 1,000 pounds per square inch;
D = outside diameter, in inches;
d = inside diameter, in inches.

(d) The elongation of the steel must be at least 20 per cent in 2 inches.

(e) The test pressure under para. 12 of this specification must be at least 1,000 pounds per square inch.

(f) Flattening test: Between knife edges, wedge shaped, 60° angle, rounded to ½ inch radius; test 1 cylinder[1] taken at random out of each lot of 200 or less, after hydrostatic test. The cylinders must pass test without cracking to 6 times wall thickness.

(g) Reports of manufacture and tests of the cylinder shells must include the following additional information: Chemical analysis data on manganese, chromium, molybdenum, and other alloy meterials present, if any; definite statement as to the heat treatment used.

Specification 8A

STEEL CYLINDERS

With approved porous filling for acetylene.

GENERAL

Cylinders manufactured under this specification prior to January 1, 1959 may be continued in service, but cylinders manufactured after this date must comply with Specification 8.

Specification 8AL

STEEL CYLINDERS

With approved porous filling for acetylene.

1. Compliance. (a) Required in all details.

2. Type and service pressure. (a) Type. Seamless except that the following is authorized: Attachment of heads by welding or by brazing by dipping process; welded circumferential body seam. Longitudinal seams not authorized.

(b) Service pressure. 250 pounds per square inch.[2]

3. Inspection by whom and where. (a) By competent and independent Inspector approved by the Canadian Transport Commission. For cylinders not made in Canada, or the United States of America, the tests, as specified shall be made within the limits of Canada, unless written permission is obtained from the Commission to conduct the tests elsewhere.

(b) Duties of shell inspector. Inspect all material and reject any not complying with requirements; for cylinders made by billet-piercing process, billets to be inspected after nick and cold break.

(1) Require certified chemical analyses of steel used, signed by manufacturer thereof; also verify by check analyses of samples taken from each heat or from 1 out of each lot of 200 or less plates, shells, or tubes used.

(2) Verify compliance of cylinder shells with all steel requirements; inspect inside before closing in both ends; verify heat treatment as proper; obtain all samples for all tests and for check analyses; witness all tests; verify threads by gauge; report volumetric capacity and minimum thickness of wall noted.

(3) Report percentage of each specified alloying element in the steel. Prepare report on manufacture of steel shells in form prescribed in sec. 24 (a). Furnish one copy to manufacturer, and three copies to the company that is to complete the cylinders.

(c) Duties of inspector of completed cylinders. Determine porosity of filling and tare weights; verify compliance of marking with prescribed requirements; obtain necessary copies of steel shell reports prescribed in paragraph (b) of this section; render complete report required by this specification to cylinder maker, Canadian Transport Commission and upon request to the purchaser.

4. Authorized steel. (a) As specified in Table I of Appendix A.

5. Identification of steel. (a) Required; any suitable method except that plates and billets for hot-drawn cylinders shall be marked with heat number.

6. Defects. (a) Material with seams, cracks, laminations, or other injurious defects, not authorized.

7. Manufacture. (a) By best appliances and methods; dirt and scale to be removed as necessary to afford proper inspection; no defect acceptable that is likely to weaken the finished cylinder appreciably; reasonably smooth and uniform surface finish required.

8. Footrings. (a) Exposed bottom welds on cylinders over 18″ long must be protected by footrings.

9. Welding or brazing. (a) The attachments to the tops or bottoms only of cylinders by welding or brazing of neckrings, footrings, handles, bosses, pads, and valve protecting rings is authorized provided that such attachments and the portion of the container to which they are attached are made of weldable steel, the carbon content of which must not exceed 0.25 per cent.

(b) Heat treatment is not required after welding or brazing weldable low carbon parts to attachments, specified in paragraph (a) of this section, of similar material which have been previously welded or brazed to the top or bottom of cylinders and properly heat treated, provided such subsequent welding or brazing does not produce a temperature in excess of 400°F. in any part of the top or bottom material.

10. Wall thickness; wall stress. (a) The calculated wall stress at 750 pounds per square inch shall not exceed 35,000 pounds per square inch, or one-half of the minimum ultimate strength of the steel as determined in sec. 16, whichever value is the smaller. Measured wall thickness shall not include galvanizing or other protective coating.

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[1] For lots of 30 or less, physical and flattening tests are authorized to be made on a ring at least 8 inches long cut from each cylinder and subjected to same heat treatment as the finished cylinder.

[2] "Service pressure" limits the use of the cylinder to 250 pounds per square inch at 70°F.

(1) Calculation of wall stress must be made by the formula:

$$S = \frac{P\,(1.3D^2 + 0.4d^2)}{D^2 - d^2}$$

where:

S = wall stress in pounds per square inch;
P = 750 pounds per square inch (minimum test pressure);
D = outside diameter in inches;
d = inside diameter in inches;

Either D or d must be calculated from the relation D=+ 2t, where t=minimum wall thickness.

(2) Cylinders with wall thickness less than 0.100 inch, the ratio of straight side wall length to outside diameter shall not exceed 3.5.

(3) For cylinders having outside diameter over 5 inches, the minimum wall thickness shall be 0.087 inch.

11. Heat-treatment. (a) Each cylinder must be uniformly and properly heat treated, prior to tests, by any suitable method in excess of 1100°F. Heat treatment must be accomplished after all forming and welding operations, except that when brazed joints are used, heat treatment must follow any forming and welding operations but may be done before, during, or after the brazing operations. Liquid quenching not authorized.

12. Openings. (a) Standard taper pipe threads required; length not less than as specified for American Standard pipe threads; tapped to gauge; clean cut, even, and without checks.

13. Safety devices and protection for valves, safety devices, and other connections. (a) If applied must be as required by the Canadian Transport Commission regulations. (See §§ 73.34(d) and 73.301(g).

14. Hydrostatic test. (a) By water-jacket, or other suitable method, operated so as to obtain accurate data. Pressure gauge must permit reading to accuracy of 1 per cent. Expansion gauge must permit reading of total expansion to accuracy either of 1 per cent or 0.1 cubic centimetre.

(b) Pressure must be maintained for 30 seconds and sufficiently longer to insure complete expansion. Any internal pressure applied after heat-treatment and previous to the official test must not exceed 90 per cent of the test pressure.

(c) Permanent volumetric expansion must not exceed 10 per cent of total volumetric expansion at test pressure.

(d) One cylinder out of each lot of 200 or less must be hydrostatically tested to at least 750 pounds per square inch. Cylinders not so tested must be examined under pressure of between 500 and 600 pounds per square inch and show no defect. If hydrostatically tested cylinder fails, each cylinder in the lot may be hydrostatically tested and those passing are acceptable.

15. Leakage test. (a) By interior air or gas pressure not less than the service pressure; leakers must be rejected. Required only for cylinders with bottoms closed in by spinning.

16. Physical test. (a) Required on 2 specimens cut longitudinally from 1 cylinder or part thereof taken at random out of each lot of 200 or less, after heat treatment.

(b) Specimens must be: Gauge length 8″ with width not over 1½″; or, gauge length 2″ with width not over 1½″: Provided, That gauge length at least 24 times thickness with width not over 6 times thickness is authorized when cylinder wall is not over 3/16″ thick.

(c) The yield strength in tension shall be the stress corresponding to a permanent strain of 0.2 per cent of the gauge length.

(1) The yield strength shall be determined by either the "offset" method or the "extension under load" method as prescribed in ASTM Standard E8-57T.

(2) In using the "extension under load" method, the total strain (or "extension under load") corresponding to the stress at which the 0.2 per cent permanent strain occurs may be determined with sufficient accuracy by calculating the elastic extension of the gauge length under appropriate load and adding thereto 0.2 per cent of the gauge length. Elastic extension calculations shall be based on an elastic modulus of 30,000,000. In the event of controversy, the entire stress-strain diagram shall be plotted and the yield strength determined from the 0.2 offset.

(3) For the purpose of strain measurement, the initial strain shall be set while the specimen is under a stress of 12,000 pounds per square inch, the strain indicator reading being set at the calculated corresponding strain.

(4) Cross-head speed of the testing machine shall not exceed ⅛″ inch per minute during yield strength determination.

17. Elongation. (a) Physical test specimens must show at least 40 per cent for 2 inch gauge length or at least 20 per cent in other cases, except that these elongation percentages may be reduced numerically by 2 for 2 inch specimens and 1 in other cases for each 7,500 pounds per square inch increment of tensile strength above 50,000 pounds per square inch to a maximum of four such increments.

18. Weld tests. (a) Specimens taken across the circumferentially welded seam must be cut from one cylinder taken at random from each lot of 200 or less cylinders after heat treatment and must pass satisfactorily the following tests:

(1) Tensile test. A specimen shall be cut from one cylinder of each lot of 200 or less, or welded test plate.[1] The specimen shall be taken across the major seam and shall be prepared and tested in accordance with and must meet the requirements of CGA Pamphlet C-3. Should this specimen fail to meet the requirements, specimens may be taken from the two additional cylinders or welded test plates from the same lot and tested. If either of the latter specimens fail to meet the requirements the entire lot represented shall be rejected.

[1] The welded test plate shall be of one of the heats in the lot of 200 or less which it represents, in the same condition and approximately the same thickness as the cylinder wall except that in no case shall it be of lesser thickness than that required for a one-quarter size Charpy impact specimen. The weld must be made by the same procedure and subjected to the same heat treatment as the major weld on the cylinder.

(2) Guided bend test. A "root" bend test specimen shall be cut from the cylinder or welded test plate, used for the tensile test specified in sub-paragraph-18(a)(1). Specimens shall be taken across the major seam and shall be prepared and tested in accordance with and shall meet the requirements of CGA Pamphlet C-3.

(3) Alternate guided bend test. This test may be used and shall be as required by CGA Pamphlet C-3. The specimen shall be bent until the elongation at the outer surface, adjacent to the root of the weld, between the lightly scribed gauge lines—a to b, shall be at least 20 per cent, except that this percentage may be reduced for steels having a tensile strength in excess of 50,000 pounds per square inch, as provided in paragraph 17(a).

19. Rejected cylinders. (a) Reheat treatment authorized; subsequent thereto, acceptable cylinders must pass all prescribed tests. Repair by welding is authorized.

20. Porous filling. (a) Cylinders must be filled with an approved porous material of such structure that it will not disintegrate or sag when wet with solvent or when subjected to normal service. The porous filling material shall be uniform in quality and free of voids, except that a well drilled into the filling material beneath the valve is authorized, provided that such a well be filled with a material of such type that the functions of the filling material are not impaired. Overall shrinkage of the filling material is authorized, provided the total clearance between the cylinder shell and filling material, after solvent has been added, does not exceed ½ of 1 per cent of the respective diameter or length but in no case to exceed ⅛ inch measured diametrically and longitudinally and that such clearances do not impair the functions of the filling material. In all cases, the filling material as installed in the cylinder must be approved by the Canadian Transport Commission or the Bureau of Explosives.

(b) Porosity of filling to be 80 per cent or less except that filling with a porosity in excess of 80 per cent but not in excess of 92 per cent, may be used when tested with satisfactory results under the supervision of the Canadian Transport Commission or the Bureau of Explosives. When the porous mass has a porosity in excess of 80 per cent but not in excess of 83 per cent, the pores shall be uniform and shall not be visible at a magnification of 200 diameters. When the porous mass has a porosity in excess of 83 per cent but not in excess of 92 per cent, the pores shall be uniform and shall not be visible at a magnification of 500 diameters. A cylinder taken at random from a lot of 200 or less must be for porosity providing the porosity of each cylinder is not known. Should test cylinders fail, test of each cylinder of the lot is authorized, cylinders passing the test to be acceptable.

(c) For filling that is moulded and dried before insertion in cylinders, porosity test may be made on sample block taken at random from material to be used.

(d) The porosity of the filling material shall be determined; the amount of solvent at 70°F. for a cylinder:

(1) Having shell volumetric capacity above 20 pounds water capacity (nominal), shall not exceed the following:

Per cent porosity of filler:	Maximum acetone solvent per cent shell capacity by volume
90 to 92	43.4
87 to 90	42.0
83 to 87	40.0
80 to 83	38.6
75 to 80	36.2
70 to 75	33.8
65 to 70	31.4

(2) Having volumetric capacity of 20 pounds or less water capacity (nominal), shall not exceed the following:

Per cent porosity of filler:	Maximum acetone solvent per cent shell capacity by volume
90 to 92	41.8
83 to 90	38.5
80 to 83	37.1
75 to 80	34.8
70 to 75	32.5
65 to 70	30.2

21. Tare weight. (a) Tare weight here referred to shall be the combined weight of cylinder proper, porous filling, valve, and solvent, but without removable cap.

22. Marking. (a) Marking on each cylinder as follows:

(1) CTC-8AL.

(2) A serial number and an identifying symbol (letters); grouped[1] above, below, or immediately following the CTC mark. The symbol and numbers must be those of purchaser, user, or maker. The symbol must be registered with the Bureau of Explosives through the Canadian Transport Commission; duplications unauthorized.

Examples:

CTC-8AL
1234
XY

CTC-8AL-1234-XY

(3) Date of test (such as 5-50 for May 1950) so placed that dates of subsequent tests can be easily added.

(4) Tare weight of cylinder in pounds and ounces.

(5) Cylinders, not completed, when delivered must each be marked for identification of each lot of 200 or less.

(b) Markings shall be stamped plainly and permanently in locations in accordance with the following:

(1) On shoulders and top heads not less than 0.087 inch thick, or

(2) On neck, valve boss, valve protection sleeve, or similar part permanently attached to the top end of cylinder, or

(3) On a plate of ferrous material attached to the top of the cylinder or permanent part thereof; the plate must be at least 1/16 inch thick, and must be attached by welding, or by brazing at a temperature of at least 1100°F. throughout all edges of the plate. Sufficient space must be left on the plate to provide for stamping at least four (4) retest dates.

[1] Variation in location authorized only when necessitated by lack of space.

23. Size of marks. (a) At least ⅛″ high for cylinders less than 4″ inside diameter and at least ¼″ high for larger cylinders.

24. Inspector's report. (a) Report to cover manufacture of acetylene shells; required to be clear, legible, and in the following form:

(Place)

(Date).....

Acetylene shells

Manufactured for.....Company

Location at

Manufactured by .....Company

Location at

Consigned to .....Company

Location at

Quantity

Size.....inches outside diameter by.....inches long.

Marks stamped into the shoulder of the cylinder are:

Lot number

Other marks (if any)

These cylinders were made by process of

The .....permitted in
(neckrings, footrings, etc.)
Sec. 9 were attached by process of

(welding—brazing)
The material used was identified by the following.....numbers
(heat-purchase order)

The material used was verified as to chemical analysis and record thereof is attached hereto. The heat numbers.....
(were—were not)
marked on the material.

All material, such as plates, billets and seamless tubing, was inspected and each cylinder was inspected both before and after closing in the ends; all that was accepted was found free from seams, cracks, laminations, and other defects which might prove injurious to the strength of the cylinder. The processes of manufacture and heat treatment of cylinders were supervised and found to be efficient and satisfactory.

The cylinder walls were measured and the minimum thickness noted was .....inch. The outside diameter was determined by a close approximation to be ..... inches. The wall stress was calculated to be. .....pounds per square inch under an internal pressure of. . pounds per square inch.

Hydrostatic tests, flattening tests, tensile tests of material, and other tests as prescribed in specification No. CTC-8AL were made in the presence of the inspector and all material and cylinders accepted were found to be in compliance with the requirements of that specification. Records thereof are attached hereto.

I hereby certify that all of these cylinders proved satisfactory in every way and comply with the requirements of the Canadian Transport Commission specification No. 8AL except as follows:

Exceptions:

(Signed).....
Inspector.

(Place)

(Date)

RECORD OF CHEMICAL ANALYSIS OF STEEL FOR CYLINDERS

Numbered. .....to..... inclusive.
Size .....inches outside diameter by .....inches long.
Made by ..... Company
For ..... Company

Test No.	Heat No.	Check analysis No.	Cylinders represented (serial Nos.)	Chemical analysis									
				C	P	S	Si	Mn	Ni	Cr	Mo	Cu	Al	Zr

Steel was manufactured by..... Company.
The original of the certified mill test reports are in files of the manufacturer.

NOTE: Any omission of analysis by heats, if authorized, must be accounted for by notation hereon reading "The prescribed certificate of the manufacturer of material has been secured, found satisfactory, and placed on file, "or by attaching a copy of the certificate.

The analysis were made by .....
(Signed).....
(Place)
(Date).....

RECORD OF PHYSICAL TESTS OF STEEL FOR CYLINDERS

Numbered.....to .....inclusive
Size .....inches outside diameter by ..... inches long
Made by ..... Company.
For ..... Company.

Test No.	Cylinders represented by test (Serial No.)	Yield strength (pounds per sq. inch)	Tensile strength (pounds per sq. inch)	Elongation strength (pounds per sq. inch)	Reduction of area (per cent)	Weld Tensile Test	Weld Bend Test

(Signed)
(Place).....
(Date

RECORD OF HYDROSTATIC TEST ON CYLINDERS

Numbered.....to..... inclusive.
Size..... inches outside diameter by.....inches long.
Made by .....Company.
For .....Company.

Serial Nos. of cylinders tested arranged numerically	Actual test pressure (pounds per square inch)	Total expansion (cubic centimetres)[1]	Permanent expansion (cubic centimetres)[1]	Per cent ratio of permanent expansion to total expansion[1]	Volumetric capacity[3]

NOTE: When specifications requires test for only 1 out of each lot of 200 or less cylinders, the check on the others must be indicated by a notation hereon reading: "Each cylinder was subject to a pressure of..... pounds per square inch and showed no defect".

1. If the tests are made by a method involving the measurement of the amount of liquid forced into the cylinder by the test pressure, then the basic data on which the calculations are made, such as the pump factors, temperature of liquid, coefficient of compressibility of liquid, etc., must also be given.
2. Report the approximate maximum and minimum volumetric capacity for the lot.

(Signed)

(b) Inspector's report to cover completed manufacture of acetylene cylinders; required to be clear and legible and in the following form:

(Place)

(Date)

Final report: For completed steel cylinders with approved porous filling for acetylene.
Manufactured for
Location at
Steel shells manufactured by
Location at
Cylinders completed by
Location at
Consigned to
Location at
Quantity ....
Size .....inches outside diameter by . inches long
Marks are stamped into
(show location)

as follows:
Specification CTC-8AL
Serial numbers .....to ..... inclusive
Identifying symbol (registered)
Inspector's mark (if applied)
Test date ... .
Other marks (if any)

Application of prescribed marks, as reported above, and location thereof were verified.

Each cylinder was filled with porous filling material consisting of . in the form of.. ....

The porosity of the filling is between ..... and per cent as determined by tests made by the ..... company whose reports has been found satisfactory and is on file.

The tare weight of each cylinder was determined and a record thereof is attached hereto.

Each cylinder has been equipped with safety devices.....

A certified report of manufacture and tests of the steel shells is attached hereto.

I hereby certify that, subject to the acceptability of the reports covering the steel shells, all of these cylinders proved satisfactory in every way and comply with the requirements of the Canadian Transport Commission specification No. 8AL.

(Signed)

(Inspector)

Specification 8WC

WELDED STEEL CYLINDERS MADE OF DEFINITELY PRESCRIBED ELECTRIC-ARC WELDED STEELS WITH LONGITUDINAL SEAM.

(With approved porous filling for acetylene)

1. Compliance. Required in all details.

2. Type and service pressure. (a) Type. The cylinders must be of a welded type with a longitudinal electric-arc welded seam. Cylinders which are closed in by spinning process are not authorized.

(b) Service pressure. 250 pounds per square inch.

3. Inspection by whom and where. (a) Inspection shall be performed by a competent and independent inspector approved by the Commission. Chemical analyses and tests, as specified are to be made within the limits of Canada or the United States, unless written permission is obtained from the Commission to conduct the tests elsewhere.

(b) Duties of shell inspector.

(1) The shell inspector shall:

i) Inspect all materials; and

ii) Reject any which do not comply with the requirements of this specification.

(2) Verify the chemical analysis of each heat of material by analysis or by obtaining a certified analysis. A certificate from the manufacturer, providing sufficient data to indicate compliance with the requirements, is acceptable when verified by a check analysis of samples taken from one cylinder out of each lot of 200 or less.

(3) i) Verify the compliance of cylinder shells with specification requirements, including: the condition of the inside, tests, threads and heat treatment.

ii) Obtain samples for all tests;

iii) Check chemical analyses;

iv) Witness all tests;

v) Report volumetric capacity, and minimum thickness of wall noted;

vi) Verify that the cylinder shell design has passed a cycling pressurization test.

(4) i) Report the percentage of each specified alloying element in the steel.

ii) Prepare a report on the manufacture of steel shells in the form prescribed in sec. 25(a).

iii) Furnish one copy to the manufacturer and three copies to the company that is to complete the cylinders.

(c) Duties of inspector of completed cylinders. Determine porosity of filling and tare weights; verify compliance of marking with prescribed requirements; obtain necessary copies of steel shell reports prescribed in paragraph (b) of this section; render complete report required by this specification to cylinder maker, Canadian Transport Commission and upon request to the purchaser.

4. Authorized steel. (a) As specified in Table 1 of Appendix A of shipping container specifications.

(b) Heads. Material for heads shall be the same as paragraph (a) of this section or shall be open hearth, electric or basic oxygen carbon steel of uniform quality. Content percentage for the following elements shall not exceed: Carbon, 0.25; Manganese, 0.60; phosphorus, .045; sulphur, .050.

(1) Heads shall be hemispherical or elipsoidal in shape with a maximum ration of 2:1. If low carbon steel is used, the thickness of such heads shall be determined by using a maximum wall stress of 24,000 psi in the formula shown in sec. 10(a) of this specification.

(2) Heads convex to pressure, must have a minimum thickness equal to 2.5 times the required sidewall thickness. Heads concave to pressure, must have a minimum thickness equal to 0.9 times the required sidewall thickness.

5. Identification of steel. Required; any suitable method.

6. Defects. Material with seams, cracks, laminations, or other injurious defects are not authorized.

7. Manufacture. (a) By best appliances and methods. Dirt and scale are to be removed as necessary to afford proper inspection. A defect that is likely to weaken the finished cylinder appreciably is not acceptable. A reasonably smooth and uniform finish is required.

(b) Circumferential seams. By electric-arc welding. Joints shall be butt or lap with the minimum overlap being at least four times the nominal sheet thickness. The minimum leg of any lapweld fillet must be at least 1.3 times the calculated minimum sidewall thickness, based on a joint efficiency of 1.0. Fillet weld beads must be flat or convex. Seams shall have complete joint penetration.

(c) Longitudinal seams in shells.

(1) Longitudinal electric-arc welded seams shall be of the butt-welded type. Welds must be made by a machine process which includes automatic feed and welding guidance mechanisms. Longitudinal seams shall have complete joint penetration and shall be free from undercuts, overlaps or abrupt ridges or valleys. Misalignment of mating butt edges shall not exceed 1/6 of the nominal sheet thickness or 1/32 inch, whichever is less. All joints with nominal sheet thickness up to and including 1/8 inch shall be tightly butted. When the nominal sheet thickness is greater than 1/8 inch, the joint shall be gapped for maximum distance equal to one-half the nominal sheet thickness or 1/32 inch whichever is less. Joint design, preparation and fit-up shall be such that the requirements of sec. 7(d) are satisfied.

(2) Maximum joint efficiency shall be 1.0 when each seam is radiographed completely. Maximum joint efficiency shall be 0.90 when one cylinder from each lot of 50 consecutively welded cylinders is spot radiographed. In addition, after a shut down of welding operations which exceeded four hours, one out of the first five cylinders welded shall be spot radiographed. Spot radiographs, when required, shall be made of a finished welded cylinder and shall include the girth weld of 2 inches in both directions from the intersection of the longitudinal and girth welds and include at least 6 inches of the longitudinal weld. Maximum joint efficiency of 0.75 shall be permissable without radiography.

(d) Welding procedures and operators must satisfy the requirements contained in the sections that apply in CGA Pamphlet C-3.

8. Footrings. Exposed bottom welds on cylinders over 18″ long must be protected by footrings.

9. Welding of attachments.

(1) The attachments by welding of neckrings, footrings, handles, bosses, pads and valve protection rings to the tops and bottoms only of cylinders is authorized, provided that such attachments and the portion of the container to which they are attached, are made of weldable steel, the carbon content of which must not exceed 0.25 per cent.

10. Wall thickness. (a) For outside diameters over 5 inches, the minimum wall thickness shall be 0.087 inch. In any case, the minimum wall thickness shall be such that the wall stress calculated by the formula (See Note 1):

$$S = \frac{3P\,(1.3D^2 + 0.4d^2)}{E\,(D^2 - d^2)}$$

NOTE 1: S = wall stress, psi;
P = service pressure, psi;
D = outside diameter, inches;
d = inside diameter, inches;
E = joint efficiency of the longitudinal seam (from sec. 7(c)(2)).

shall not exceed the lesser value of the following:

(1) 35,000 pounds per square inch; or

(2) one-half the minimum tensile strength of the material

(b) In any cylinder with a wall thickness less than 0.100 inch, the ratio of straight sidewall length to outside diameter shall not exceed 3.5.

11. Heat treatment. (a) Each cylinder must be uniformly and properly heat treated prior to testing by the applicable method shown in Table 1 of Appendix A of shipping container specifications. Heat treatment must be accomplished after all forming and welding operation.

(b) Heat treatment is not required after welding or brazing weldable low carbon parts to attachments of similar material which have been previously welded to the top or bottom of cylinders and properly heat treated, provided such subsequent welding or brazing does not produce a temperature in excess of 400°F in any part of the top or bottom material.

12. Openings in cylinders. (a) All openings must be in the heads or bases.

(b) Openings in cylinders must be provided with adequate fittings, bosses or pads, integral with or securely attached to the cylinder by welding.

(c) Standard taper pipe threads are required; the length shall not be less than as specified for American Standard

pipe threads. They are to be tapped to gauge, clean cut, even and without checks.

(d) The closure of fittings, boss or pads must be adequate to prevent leakage.

13. Safety devices and protection for valves, safety devices, and other connections. If applied, they must be as required by sec. 73.34(d) and 73.301(g) of these Regulations.

14. Hydrostatic test. (a) Hydrostatic tests shall be done by water-jacket, or another suitable method operated so as to obtain accurate data. The pressure gauge must permit accurate reading to within 1 per cent. The expansion gauge must permit accurate reading of the total expansion to within 1 per cent, or 0.1 cubic centimetre.

(b) Pressure must be maintained for 30 seconds and sufficiently longer to insure complete expansion. Any internal pressure applied after heat-treatment and before the official test, must not exceed 90 per cent of the text pressure.

(c) Permanent volumetric expansion must not exceed 10 per cent of the total volumetric expansion at test pressure.

(d) One cylinder out of each lot of 200 or less must be hydrostatically tested to at least 750 pounds per square inch.

(1) If a hydrostatically tested cylinder fails, each cylinder in the lot may be hydrostatically tested and those passing are acceptable. Independent Agency must issue detailed report describing rejected and accepted cylinders (See sec. 3).

(2) Cylinders not hydrostatically tested must be examined under pressure of between 500 and 600 pounds per square inch and show no defect.

(e) One finished shell, selected at random out of each lot of 500 or less sucessively produced, shall be hydrostatically tested to 6 times service pressure without bursting.

15. Physical test. (a) To determine yield strength, tensile strength and elongation of material. The test is required to be done on a specimen cut from each head and body section of a cylinder having passed the hydrostatic test.

(b) Specimens must be: A gauge length of 8 inches with the width not over 1½ inches or gauge length 2 inches with width not over 1½ inches, provided that the gauge length at least 24 times the thickness with the width not over 6 times the thickness, is authorized when the cylinder wall is not over 3/16 inch thick. The specimen, exclusive of grip ends, must not be flattened. Grip ends may be flattened to within 1 inch of each end of the reduced section. When the size of the cylinder does not permit securing straight specimens, the specimens may be taken in any location of direction and may be straightened or flattened cold, by pressure only, not by blows; when specimens are so taken and prepared, the inspector's report must show, in connection with the record of physical tests, detailed information in regard to such specimens. Heating of specimens for any purpose is not authorized.

(c) Yield strength in tension shall be the stress corresponding to a permanent strain of 0.2 percent of the gauge length.

(1) The yield strength shall be determined by either the "offset" method or the "extension under load" method as prescribed in ASTM Standard E8-77.

(2) In using the "extension under load" method, the total strain (or "extension under load") corresponding to the stress at which the 0.2 per cent permanent strain occurs, may be determined with sufficient accuracy by calculating hereto 0.2 per cent of the gauge length. Elastic extension calculations shall be based on an elastic modulus of 30,000,000. In the event of controversy, the entire stress-strain diagram shall be plotted and the yield strength determined from the 0.2 per cent offset.

(3) For the purpose of strain measurement, the initial strain reference shall be set while the specimen is under the stress of 12,000 psi, the strain indicator reading being set at the calculated corresponding strain.

(4) The cross-head speed of the testing machine shall not exceed ⅛ inch per minute during the yield strength determination.

16. Elongation. (a) Physical test specimens must show at least 40 per cent for 2-inch gauge length or at least 20 per cent in other cases, except that these elongation percentages may be reduced numerically by 2 for 2 inch specimens, and by one, in other cases, for each 7,500 psi increment of tensile strength above 50,000 psi to a maximum of four increments.

17. Test of Welds. (a) Tensile test. A specimen shall be cut from one cylinder of each lot of 200 or less. The specimen shall be taken across the longitudinal seam and shall be prepared and tested in accordance with, and must meet the requirements of, CGA Pamphlet C-3. Failure must occur in the parent metal.

(b) Guided bend test. A "root" test specimen shall be cut from the cylinder used for the tensile test specified in sec. 17(a). Specimens shall be taken across the longitudinal seam and shall be prepared and tested in accordance with, and must meet the requirements of, CGA Pamphlet C-3.

(c) Alternate guided bend test. This test may be used and shall be as required by CGA Pamphlet C-3. The specimen shall be bent and the elongation at the outer surface, adjacent to the root of the weld, between the lightly scribed gauge lines a to b, shall be at least 20 per cent, except that this percentage may be reduced for steels having a tensile strength in excess of 50,000 psi, as provided in sec. 16(a).

(d) Macroetch test. A sample of fillet lap welds used to attach heads must be cut from the cylinder used in sec. 17(a) above. The sample shall be cut across the fillet weld, macroetched and visually examined for full pene-

tration at the root and into both members, the length of leg and contour of weld bead.

18. Radiographic examination. (a) Radiographic inspection shall conform to the techniques and acceptability criteria set forth in CGA Pamphlet C-3.

(b) Should spot radiographic examination fail to meet the requirements of paragraph (a) of this section, two additional welds from the same lot of 50 cylinders or less shall be examined, and if either of these fail to meet the requirements, each cylinder shall be examined as previously outlined, and only those passing are acceptable.

19. Cycling tests for Shells. (a) Prior to the initial shipment of any specific cylinder design, cyclic pressurization tests shall have been performed on at least three representative samples without a failure, as follows: Pressurization shall be performed hydrostatically between approximately zero psig and 400 psig at a rate not in excess of 10 cycles per minute and for at least 10,000 cycles. Adequate recording instrumentation shall be provided if equipment is to be left unattended for periods of time.

(b) All shells subjected to cycling test shall be submitted to the test prescribed in sec. 14(a), (b) and (c) above and shall pass this test at a testing pressure of at least 750 pounds per square inch.

(c) All shells used in cycling must be destroyed.

20. Rejected cylinders. (a) Unless otherwise stated, if a sample cylinder or specimen taken from a lot of cylinders fails the prescribed test, then two additional specimens must be selected from the same lot and subjected to the prescribed test. If either of these fail the test, then the entire lot must be rejected.

(b) Reheat treatment is authorized; subsequent thereto, acceptable cylinders must pass all prescribed tests. The repair of welded seams by welding is authorized, provided that all defective metal is cut away and the joint is rewelded as prescribed for the original welded joints.

21. Porous filling. (a) Cylinders must be filled with an approved porous material of such structure that it will not disintegrate or sag when wet with solvent or when subjected to normal service. The porous filling material shall be uniform in quality and free of voids, except that a well drilled into the filling material beneath the valve is authorized, provided that such a well be filled with a material of such type that the functions of the filling material are not impaired. Overall shrinkage of the filling material is authorized, provided the total clearance between the cylinder shell and the filling material, after the solvent has been added, does not exceed ½ of 1 per cent of the respective diameter or length, but in no case to exceed ⅛ inch measured diametrically and longitudinally and that such clearances do not impair the functions of the filling material. In all cases, the filling material, as installed in the cylinder, must be approved by the Canadian Transport Commission or the Bureau of Explosives.

(b) The porosity of the filling is to be 80 per cent or less, except that filling with a porosity in excess of 80 per cent, but not in excess of 92 per cent, may be used when tested with satisfactory results under the supervision of the Canadian Transport Commission or the Bureau of Explosives. When the porous mass has a porosity in excess of 80 per cent but not in excess of 83 per cent, the pores shall be uniform and shall not be visible at a magnification of 200 diameters. When the porous mass has a porosity in excess of 83 per cent but not in excess of 92 per cent, the pores shall be uniform and shall not be visible at a magnification of 500 diameters. A cylinder taken at random from a lot of 200 or less must be tested for porosity providing the porosity of each cylinder is not known. Should test cylinders fail, a test of each cylinder of the lot is authorized, and cylinders passing the test are acceptable.

(c) For filling that is moulded and dried before insertion in the cylinders, the porosity test may be made on a sample block taken at random from the material to be used.

(d) The porosity of the filling material shall be determined; the amount of solvent of 70°F. for a cylinder:

(1) Having shell volumetric capacity above 20 pounds water capacity (nominal), shall not exceed the following:

Percent porosity of filling	Maximum acetone solvent per cent shell capacity by volume
90 to 92	43.4
87 to 90	42.0
83 to 87	40.0
80 to 83	38.6
75 to 80	36.2
70 to 75	33.8
65 to 70	31.4

(2) Having volumetric capacity of 20 pounds or less water capacity (nominal), shall not exceed the following:

Percent porosity of filling	Maximum acetone solvent per cent shell capacity by volume
90 to 92	41.8
83 to 90	38.5
80 to 83	37.1
75 to 80	34.8
70 to 75	32.5
65 to 70	30.2

22. Tare weight. (a) Tare weight, here referred to, shall be the combined weight of the cylinder proper, porous filling, valve, saturation acetylene and solvent, but without the removable cap.

23. Marking. (a) Marking on each cylinder shall be as follows:

(1) CTC-8WC

(2) A serial number and an identifying symbol (letters): grouped[1] above, below, or immediately following the CTC mark. The symbol and numbers must be those of purchaser, user, or maker. The symbol must be registered with the Bureau of Explosives through the Canadian Transport Commission; duplications are unauthorized.

Examples:

CTC-8WC
1234
XY

CTC-8WC-1234-XY

(3) Date of the test (such as 5-77 for May 1977) so placed, that dates of subsequent tests can be easily added.

(4) Tare weight of cylinder in pounds and ounces.

[1] Variation in location authorized only when necessitated by lack of space

(5) Cylinders, not completed, when delivered must each be marked for identification of each lot of 200 or less.

(b) Markings shall be stamped plainly and permanently in locations in accordance with the following:

(1) On shoulders and top heads not less that 0.087 inch thick, or

(2) On neck, valve boss, valve protection sleeve, or similar part permanently attached to the top end of cylinder, or

(3) On a plate of ferrous material attached to the top of the cylinder or permanent part thereof; the plate must be at least 1/16 inch thick, and must be attached by welding, or by brazing at a temperature of at least 1100°F. throughout all edges of the plate. Sufficient space must be left on the plate to provide for stamping at least four (4) retest dates.

24. Size of marks. (a) At least ⅛″ high for cylinders less than 4″ inside diameter and at least ¼″ high for larger cylinders.

25. Inspector's report. (a) Report to cover manufacture of acetylene shells; required to be clear, legible, and in the following form:

(Place) .....
(Date) .....

Acetylene shells
Manufactured for ..... Company
Location at .....
Manufactured by ..... Company
Location at .....
Consigned to ..... Company
Location at .....
Quantity .....
Size ..... inches outside diameter by ..... inches long
Marks stamped into the shoulder of the cylinder are:
Specification CTC .....
Serial numbers ..... to ..... Inclusive
Inspector's mark .....
Identifying symbol (registered) .....
Test date .....
Tare weights (yes or no) .....
Other marks .....
.....
.....
These cylinders were made by process of .....
.....
The material used was type ..... authorized in Table 1 of Appendix A, page 325B.
The material used was identified by the following ..... numbers
(heat purchase order)

The material used was verified as to chemical analysis and record thereof is attached hereto. The heat numbers .....
(were-were not)
marked on the material. All material was inspected and all that was accepted was found free from seams, cracks, laminations and other injurious defects.
Radiography .....
(type and amount)

The compliance of cylinders with specification requirements was verified including markings, condition of inside, tests, threads, etc. All cylinders with defects which might prove injurious were rejected. The processes of manufacture and head treatment were supervised and found to be efficient and satisfactory.

The cylinder walls were measured and the minimum thickness noted was ..... inch. The outside diameter was determined to be ..... inches. The wall stress was calculated to be ..... pounds per square inch.

Hydrostatic tests, tensile tests of material, and other tests as prescribed in specification No. 8WC ..... were made in the prescence of the Inspector and all cylinders accepted were found to be in compliance with the requirements of that specification. Records thereof are attached hereto.

Cylinder shell design has passed cycling pressurization test.

I hereby certify that all of these cylinders proved satisfactory in every way and comply with the requirements of specification No. 8WC of the "Regulations for the Transportation of Dangerous Commodities by Rail" except as follows:

Exceptions

.....
(Manufacturer's name)

(Signed) .....
Inspector

(By)

(Place)
(Date

RECORD OR CHEMICAL ANALYSIS OF STEEL FOR CYLINDERS

Numbers ..... to ..... inclusive
Size ..... inches outside diameter by ..... inches long.
Made by ..... Company
For ..... Company

Test No.	Heat No.	Check Analysis No.	Cylinders represented (Serial Nos.)	Chemical analysis										
				C	P	S	Si	Mn	Ni	Cr	Mo	Cu	Al	Zr

Steel was manufactured by ..... Company.
The original of the certified mill test reports are in files of the manufacturer.

NOTE: Any omission of analysis by heats, if authorized, must be accounted for by notation hereon reading "The prescribed certificate of the manufacturer of material has been secured, found satisfactory, and placed on file, "or by attaching a copy of the certificate.

Chemical analysis was made by

(Place)
(Date)

RECORD OF PHYSICAL TESTS OF STEEL FOR CYLINDERS

Numbered ..... to ..... inclusive
Size ..... inches outside diameter by ..... inches long
Made by ..... Company.
For ..... Company.

Test No.	Cylinders represented by test (Serial No.)	Yield strength (pounds per sq. inch)	Tensile strength (pounds per sq. inch)	Elongation strength (pounds per sq. inch)	Reduction of area (per cent)	Weld Tensile Test	Weld Bend Test

(Signed)

(Place)
(Date .....

RECORD OF MACROETCH TEST

Numbered ..... to ..... inclusive.
Size ..... inches outside diameter by ..... inches long.
Made by ..... Company.
For ..... Company.

Test No.	Cylinders represented by test (Serial No.)	Penetration Depth	Length of leg	Contour of Weld bead

(Signed)

(Place)
(Date) .....

RECORD OF HYDROSTATIC TEST ON SHELLS

Numbered ..... to ..... inclusive.
Size ..... inches outside diameter by ..... Inches long.
Made by ..... Company.
For ..... Company.

Serial numbers of cylinders tested arranged numerically	Actual test pressure (pounds per sq. inch	Total expansion (cubic cm)[1]	Permanent expansion (cubic cm)[1]	Permanent ratio of permanent expansion to total expansion	Burst test (Pounds per sq. inch)	Tare Weight (Pounds)[2]	Volumetric capacity[2]

NOTE: When specifications require test for only 1 out of each lot of 200 or less cylinders, the check on the others must be indicated by a notation hereon reading: "Each cylinder was subject to a pressure of..... pounds per square inch and showed no defect".

1. If the tests are made by a method involving the measurement of the amount of liquid forced into the cylinder by the test pressure, then the basic data on which the calculations are made, such as the pump factors, temperature of liquid, coefficient of compressibility of liquid, etc., must also be given.
2. Report the approximate maximum and minimum volumetric capacity for the lot.

(Signed)

(b) Inspector's report cover completed manufacture of acetylene cylinders; required to be clear and legible and in the following form:

(Place)
(Date)

Final report: For completed steel cylinders with approved porous filling for acetylene.
Manufactured for .....
Location at
Steel shells manufactured by .....
Location at .....
Cylinders completed by .....
Location at .....
Consigned to .....
Location at .....
Quantity .....
Size .....inches outside diameter by .....inches long
Marks are stamped into .....
(Show location)
as follows:
Specification CTC-8WC
Serial numbers .....to .....inclusive
Identifying symbol (registered)
Inspector's mark (if applied) .....
Test date
Other marks (if any)

Application of prescribed marks, as reported above, and location thereof were verified.

Each cylinder was filled with porous filling material consisting of .....in the form of.....

The porosity of the filling is between .....and .....per cent as determined by test made by the .....Company whose reports has been found satisfactory and is on file.

The tare weight of each cylinder was determined and a record thereof is attached hereto.

Each cylinder has been equipped with safety devices.....

A certified report of manufacture and tests of the steel shells is attached hereto.

I hereby certify that, subject to the acceptability of the reports covering the steel shells, all of these cylinders proved satisfactory in every way and comply with the requirements of specification No. 8WC of the "Regulations for the Transportation of Dangerous Commodities by Rail".

(Signed).....
(Inspector)

Steel was manufactured by ..... Company.
The originals of the certified mill test reports are in files of the manufacturer.

NOTE: Any omission of analysis by heats, if authorized, must be accounted for by notation hereon reading "The prescribed certificate of the manufacturer of material has been secured, found satisfactory, and placed on file, "or by attaching a copy of the certificate.

The analysis were made by

(Signed)

(Place)

(Date).....

RECORD OF PHYSICAL TESTS OF STEEL FOR CYLINDERS

Numbered..... to ..... inclusive.
Size ..... inches outside diameter by ..... inches long.
Made by ..... Company
For ..... Company

Test No.	Cylinders represented by test (serial Nos.)	Yield strength (pounds per square inch)	Tensile strength (pounds per square inch)	Elongation (per cent in 8 inches)	Reduction of area (per cent)	Weld tensile test	Weld bend test

(Signed)

(Place)
(Date

RECORD OF HYDROSTATIC TEST ON CYLINDERS

Numbered.....to ..... inclusive.
Size.....inches outside diameter by.....inches long.
Made by ..... Company.
For ..... Company.

Serial Nos. of cylinders tested arranged numerically	Actual test pressure (pounds per square inch)	Total expansion (cubic centimetres)[1]	Permanent expansion (cubic centimetres)[1]	Per cent ratio of permanent expansion to total expansion[1]	Volumetric capacity[3]

NOTE: When specifications requires test for only 1 out of each lot of 200 or less cylinders, the check on the others must be indicated by a notation hereon reading: "Each cylinder was subject to a pressure of..... pounds per square inch and showed no defect".

1. If the tests are made by a method involving the measurement of the amount of liquid forced into the cylinder by the test pressure, then the basic data on which the calculations are made, such as the pump factors, temperature of liquid, coefficient of compressibility of liquid, etc., must also be given.
2. Report the approximate maximum and minimum volumetric capacity for the lot.

(Signed)

(b) Inspector's report to cover completed manufacture of acetylene cylinders; required to be clear and legible and in the following form:

(Place)
(Date) .....

Final report: For completed steel cylinders with approved porous filling for acetylene.
Manufactured for
Location at .....
Steel shells manufactured by
Location at
Cylinders completed by
Location at .....
Consigned to ....
Location at
Quantity

Size .. . inches outside diameter by .... inches long
Marks are stamped into
(show location)

as follows:
Specification CTC-8WC
Serial numbers . . .. to .. . . .inclusive
Identifying symbol (registered)
Inspector's mark (if applied)
Test date
Other marks (if any)

Application of prescribed marks, as reported above, and location thereof were verified.

Each cylinder was filled with porous filling material consisting of
in the form

The porosity of the filling is between ... . .and ... .per cent as determined by tests made by the .. ..Company whose reports has been found satisfactory and is on file.

The tare weight of each cylinder was determined and a record thereof is attached hereto.

Each cylinder has been equipped with safety devices

A certified report of manufacture and tests of the steel shells is attached hereto.

I hereby certify that, subject to the acceptability of the reports covering the steel shells, all of these cylinders proved satisfactory in every way and comply with the requirements of the Canadian Transport Commission specification No. 8WC.

(Signed)

(Inspector)

Specification 9 (Cancelled)

Specification 10B

WOODEN BARRELS AND KEGS (TIGHT)

1. Compliance. (a) Required in all details.

2. Staves and headings. (a) To be of white oak, chestnut oak, red oak, black cherry, Douglas fir, beech, sweet birch, yellow birch, sugar (hard) maple, or Scandinavian pine; quarter sawed with the grain, from straight-grained timber, so no annular ring shall slope over half the thickness of stave or head; thoroughly kiln dried, moisture content 7 per cent to 11 per cent; free from rotten sap, checks, pitch pockets, cat faces, seed and worm holes in excess of 15 in one container, and other defects that show through on both sides.

3. Hoops. (a) To be of cooperage-grade hoop steel.

4. Staves. (a) Staves to be sawed evenly and circular; croze centre to be within 1⅛″ of end of stave; stave end to have ⅛″ free from bevel.

5. Heading. (a) Heading of uniform thickness and properly circled; planed on outside and properly jointed and glued, or dowelled and flagged; dowel diameter not over 5/12 thickness of head.

6. The barrel. (a) Stave joints reasonably flush on outside. Lathing is forbidden.

(b) Worm and seed holes to be plugged; over 15 not authorized in one container.

7. Parts required and dimensions. (a) Parts required and dimensions as follows (10 per cent excess capacity authorized):

(1) Staves, when finished on outside:

Capacity of container, not over	Maximum			Minimum	
	Length	Width	Bilge circle	Staves	Thickness
Gallons	Inches	Inches	Inches	Number	Inch
46	34	6	84	19	11/16
25	30	5	74	16	5/8
12 1/2	24	4 1/2	54	14	9/16
8 1/2	22	4 1/4	50	12	1/2
5	18	4	40	10	1/2

Foregoing thicknesses are of staves finished on one side. One-sixteenth inch must be added for unfinished staves.

Foregoing maximum lengths are authorized to be increased 6 per cent or less, provided the thickness of stave is increased at least one-sixteenth inch for each increase of 1 inch in length or fraction thereof.

(2) Heading, after planing:

Capacity of container, not over	Maximum		Minimum	
	Pieces	Diameter	Thickness	Width
Gallons	Number	Inches	Inch	Inches
46	6	21	3/4	2 1/2
25	6	18	5/8	2 1/2
12 1/2	5	14	9/16	2
8 1/2	5	13	1/2	2
5	4	11	1/2	2

NOTE 1: Until further order of the Commission, for barrels of not over 46 gallons capacity, maximum number of pieces may be 7 provided they have a minimum thickness of 7/8 inch.

(3) Hoops, number and size:

Capacity of container, not over (gallons)	Minimum number of hoops	Minimum size of hoops (inches in width and Birmingham gauge)							
		Head		First quarter		Second quarter		Bilge	
		Inch	Gauge	Inch	Gauge	Inch	Gauge	Inch	Gauge
46	[1]8	[2]1 3/4	[2]17	1 1/2	18	1 1/2	18	[2]1 3/4	[2]17
25	6	1 1/2	18	1 1/4	19	.....	.....	1 1/2	18
12 1/2	6	1 1/4	19	1 1/8	19	.....	.....	1 1/4	19
8 1/2	6	1 1/2	19	1	19	.....	.....	1 1/8	19
5	[3]6	1	19	1	19	.....	.....	1	19

[1]Until further order of the Commission the minimum number of hoops is authorized to be reduced to 6 by eliminating second quarter hoops.

[2]Until further order of the Commission, the minimum number of hoops is authorized to be reduced to 4 by eliminating first quarter hoops if head and bilge hoops of 1 3/4 inch by 17 gauge are used.

[3]2 inch by 18 gauge hoops are also authorized.

8. Closures. (a) To be such as to prevent leakage in transit. Bung holes in staves must be not over 2″ diameter.

9. Lining. (a) To be as prescribed in Part 73 or otherwise appropriate for the contents.

10. Type test. (a) Sample container at least 2 days old shall not increase more than 10 per cent in diameter of head when all hoops above bilge are removed.

11. Leakage test. (a) Required for each lined container; by pressure at time of sizing or air pressure of at least 5 pounds per square inch; leakers to be repaired and retested.

12. Marking. (a) Marking on each container by the maker. By hot branding iron on head as follows:

(1) CTC-10B. This mark shall be understood to certify that the container complies with all specification requirements.

(2) Name or symbol (letters) of maker; this must be registered with the Bureau of Explosives through the Commission and located just above, below, or following the mark specified in paragraph (a)(1) of this section.

(3) Date of manufacture (for example, 7-50 for July 1950) located near the maker's mark.

NOTE 1: Until further order of the Commission, date of manufacture may be omitted.

13. Size of markings. (a) Size of markings (minimum): ¾" high for over 25-gallon size, ½" for others.

Specification 11A

WOODEN BARRELS AND KEGS (SLACK)

1. Compliance. (a) Required in all details.

2. Classification of woods. (a) As follows:

GROUP A

Oak	Red Gum	Birch
Beech	Sycamore	Douglas fir
Maple	Hackberry	White ash
Elm		

GROUP B

Cottonwood	Tupelo gum	Chestnut
Basswood	Pine	Willow

NOTE 1: Until further order of the Board, cottonwood and poplar are authorized to be included in Group A woods.

3. Staves. (a) Staves of Group A woods, No. 1 grade, kiln dried; of uniform thickness, well equalized, circled, and jointed; minimum thickness 5 staves to 1⅞"; maximum width 5½".

(b) To be tongued and grooved.

4. Heading. (a) Heading to be No. 1 grade, kiln dried, uniform thickness, turned true to size, dressed on one side, and jointed and glued.

5. Metal hoops. (a) Hoops of cooperage-grade hoop steel with one edge beaded or rolled.

6. Wooden hoops. (a) No. 1 grade coiled elm at least 9/32" × 5/23" × 1⅜"; ends joined by 1 staple and 2 additional nails or staples clinched on the inside or by 4 nails or 3 staples clinched on the inside.

7. Parts and dimensions. (a) Parts and dimensions as follows:

Authorized net weight (pounds)	Heading: Diameter not over[1] (inch)	Heading: Thickness at least, Wood group A (inch)	Heading: Thickness at least, Wood group B (inch)	Heading: Number of pieces not over	Staves: Length not over[3] (inch)	Metal hoops[4]: Width (inch) by Birmingham wire gauge (minimum), Head	Metal hoops[4]: Width (inch) by Birmingham wire gauge (minimum), Quarter[2] and bilge
350	16	1/2	1/2	3	28 1/2	1 5/8 × 23	1 3/8 × 23
450	16	1/2	5/8	3	28 1/2	1 5/8 × 23	1 3/8 × 23
600	16	5/8	5/8	3	28 1/2	1 5/8 × 23	1 3/8 × 23
350	17	1/2	1/2	4	30	1 5/8 × 23	1 3/8 × 23
450	17	1/2	5/8	4	30	1 5/8 × 23	1 3/8 × 23
600	17	5/8	5/8	4	30	1 5/8 × 23	1 3/8 × 23
350	19	1/2	1/2	5	34	1 5/8 × 22	1 3/8 × 23
450	19	1/2	5/8	5	34	1 5/8 × 22	1 3/8 × 23
600	19	5/8	5/8	5	34	1 5/8 × 22	1 3/8 × 23
350	21	1/2	1/2	5	34	1 5/8 × 21 or 2 × 22	1 3/8 × 23
450	[1]21	1/2	5/8	5	34	1 5/8 × 21 or 2 × 22	1 3/8 × 23
600	[1]21	5/8	5/8	5	34	1 5/8 × 21 or 2 × 22	1 3/8 × 23

[1] Head battens required: at least 1/2" × 3 1/2"; ends rounded to fit chime; securely nailed to heads.
[2] Quarter hoops not required for 350 pounds authorized net weight.
[3] Tolerance of 1 8" authorized.
[4] Wooden hoops authorized: 8 for 350 pounds net; 10 for 450 pounds net; 12 for 600 pounds net.

8. Head liners. (a) Required as provided in sec. 13.

9. Marking. (a) Marking on each container to be applied by the maker on top head as follows:

(1) CTC-11A; followed by the authorized gross weight (authorized net weight plus tare weight; for example, CTC-11A475, etc.). This mark shall be understood to certify that the container complies with all specification requirements.

(2) Name or symbol (letters) of maker; this must be registered with the Bureau of Explosives through the Commission and located just above, below, or following the mark specified in paragraph (a) (1) of this section.

10. Size of marking. (a) Size of marking (minimum): ¾" high for head diameter over 17"; ½" high for others.

11. Heads. (a) To fit well in croze and be secured by nails or staples at 8" spacing through hoops into heads.

12. Head battens (when required by sec. 7). (a) To be fastened at each end by ½" metal strapping nailed over chime and under hoops.

13. Head liners. (a) To extend across grain, circle at least ½ of circumference, and be nailed or stapled at 5" intervals. Required for containers with wooden hoops when net weight of contents is to exceed 250 pounds.

14. Quarter and bilge hoops. (a) To be redriven and fastened by 4 fasteners for each hoop; puncture fastening at 8" intervals authorized for metal hoops.

Specification 11B

WOODEN BARRELS AND KEGS (SLACK)

1. Compliance. (a) Required in all details.

2. Classification of woods. (a) As follows:

GROUP A

Oak	Red Gum	Birch
Beech	Sycamore	Douglas fir
Maple	Hackberry	White ash
Elm		

GROUP B

Cottonwood	Tupelo gum	Chestnut
Basswood	Pine	Willow

NOTE 1: Until further order of the Commission, cottonwood and poplar are authorized to be included in Group A woods.

3. Staves. (a) Staves of Group A woods, No. 1 grade, kiln dried; of uniform thickness, well equalized, circled, and jointed; minimum thickness 5 staves to 1⅞″; maximum width 5½″. Group B woods authorized for 24″ or shorter staves.

4. Heading. (a) Heading to be No. 1 grade, kiln dried, uniform thickness, turned true to size, dressed on one side, and jointed.

5. Metal hoops. (a) Hoops of cooperage-grade hoop steel with one edge beaded or rolled.

6. Wooden hoops. (a) No. 1 grade coiled elm at least 9/32″ × 5/32″ × 1⅜″; ends joined by 1 staple and 2 additional nails or staples clinched on the inside or by 4 nails or 3 staples clinched on the inside.

7. Parts and dimensions. (a) Parts and dimensions as follows:

Authorized net weight (pounds)	Heading				Staves	Metal hoops[4]	
	Diameter not over[1] (inch)	Thickness at least		Number of pieces not over	Length not over[3] (inch)	Width (inch) by Birmingham wire gauge (minimum)	
		Wood group				Head	Quarter[2] and bilge
		A (inch)	B (inch)				
350	16	1/2	1/2	3	28 1/2	1 5/8 × 23	1 3/8 × 23
450	16	1/2	5/8	3	28 1/2	1 5/8 × 23	1 3/8 × 23
600	16	5/8	5/8	3	28 1/2	1 5/8 × 23	1 3/8 × 23
350	17	1/2	1/2	4	30	1 5/8 × 23	1 3/8 × 23
450	17	1/2	5/8	4	30	1 5/8 × 23	1 3/8 × 23
600	17	5/8	5/8	4	30	1 5/8 × 23	1 3/8 × 23
350	19	1/2	1/2	5	34	1 5/8 × 22	1 3/8 × 23
450	19	1/2	5/8	5	34	1 5/8 × 22	1 3/8 × 23
600	19	5/8	5/8	5	34	1 5/8 × 22	1 3/8 × 23
350	21	1/2	1/2	5	34	1 5/8 × 21 or 2 × 22	1 3/8 × 23
450	[1]21	1/2	5/8	5	34	1 5/8 × 21 or 2 × 22	1 3/8 × 23
600	[1]21	5/8	5/8	5	34	1 5/8 × 21 or 2 × 22	1 3/8 × 23

[1] Head battens required: at least 1/2″ × 3 1/2″; ends rounded to fit chime; securely nailed to heads.
[2] Quarter hoops not required for 350 pounds authorized net weight.
[3] Tolerance of 1/8″ authorized.
[4] Wooden hoops authorized: 8 for 350 pounds net; 10 for 450 pounds net; 12 for 600 pounds net.

8. Head liners. (a) Required as provided in sec. 13.

9. Marking. (a) Marking on each container to be applied by the maker on top head as follows:

(1) CTC-11B; followed by the authorized gross weight (authorized net weight plus tare weight; for example, CTC-11B370, etc.). This mark shall be understood to certify that the container complies with all specification requirements.

(2) Name or symbol (letters) of maker; this must be registered with the Bureau of Explosives through the Commission and located just above, below, or following the mark specified in paragraph (a) (1) of this section.

10. Size of marking. (a) Size of marking (minimum): ¾″ high for head diameter over 17″; ½″ high for others.

11. Heads. (a) Heads to fit well in croze and be secured by nails or staples at 8″ spacing through hoops into heads.

12. Head battens (when required by sec. 7). (a) To be fastened at each end by ½″ metal strapping nailed over chime and under hoops.

13. Head liners. (a) To extend across grain circle at least ½ of circumference, and be nailed or stapled at 5″ intervals. Required for containers with wooden hoops when net weight of contents is to exceed 250 pounds.

14. Quarter and bilge hoops. (a) To be redriven and fastened by 4 fasteners for each hoop; puncture fastening at 8″ intervals authorized for metal hoops.

Specification 12A

FIBREBOARD BOXES

Nonreusable containers

1. Compliance. (a) Required in all details.

2. Definitions. (a) Terms such as "200-pound test" mean minimum strength. Mullen or Cady test.

(b) "Joints" are where edges of parts of box, except recessed flanged heads, are connected together in setting up the box. Generally done by box maker.

3. Classification of board. (a) Fibreboard is hereby classified by strength[1] of completed board as in first column of the following table; weights specified in the table are the minimums authorized.

Classified strength[1] of completed board	Facings for corrugated fibreboard	
	Double-faced—Minimum combined weight of facings (pounds per 1,000 sq. ft.)	Double-wall—Minimum combined weight of facings including centre liner (pounds per 1,000 sq. ft.)
200	84	92
275	138	110

[1] Mullen or Cady test (minimum).

4. Corrugated fibreboard. (a) Both outer facings water resistant; corrugated sheets must be at least 0.009 inch thick and weigh not less than 26 pounds per 1000 square feet; all parts must be securely glued together throughout all contact areas.

5. Tests. (a) Acceptable board must have prescribed strength, Mullen or Cady test, after exposure for at least 3 hours to normal atmospheric conditions (50 to 70 per cent relative humidity), under test as follows:

(1) Clamp board firmly in machine and turn wheel thereof at constant speed of approximately 2 revolutions per second.

(2) Six punctures required, 3 from each side; all results but one must show prescribed strength.

(3) Board failing may be retested by making 24 punctures, 12 from each side, when all results but 4 show prescribed strength the board is acceptable.

(4) Double-pop tests may be disregarded.

6. Boxes authorized. (a) Corrugated fibreboard boxes having gross weight not over 80 pounds of the following strengths are authorized:

Gross weight not over (pounds)	Corrugated fibreboard strength (Mullen or Cady test) minimum	
	Double-faced	Double-wall
20	200	200
50	275	200
80	....	275

7. Forming. (a) Parts must be cut true to size and so creased and slotted as to fit closely into position without cracking, surface breaks, separation of parts outside of crease, or undue binding.

8. Joints. (a) For slotted containers: Lapped 1½″ from centre of scoreline except as in paragraph 8(b)(2); stitched at 2½″ intervals and within 1″ of each end of joint; body joint must be double-stitched (2 parallel stitches) at each end of joint over 18″ long.

(b) Joints as provided for by the following are authorized provided resulting joint is capable of withstanding the tests prescribed by para. 10.

(1) For slotted containers only; one butt joint, taped, is authorized.

(2) For glued lap joint, the sides of box forming joint must lap not less than 1¼ inches and be firmly glued throughout entire area of contact with a glue or adhesive which cannot be dissolved in water after the film application has dried.

(3) For triple and double-slide boxes; joints of all slides must be taped or stitched.

9. Inside cushioning. (a) Sufficient inside cushioning shall be required for protection of inside containers so that completed packages as offered for shipment shall be capable of withstanding test prescribed by para. 10.

10. Test for completed package. (a) A minimum of 4 boxes with inside containers filled with water and box closed as for shipment, shall be capable of withstanding the following drop tests from the prescribed heights on to solid concrete without leakage from or breakage of any inside container or rupture of the outside fibreboard box; each box shall be subjected to not more than one of the series of tests:

(1) Box No. 1. Flat drop on bottom from height of 4 feet.

(2) Box No. 2. Flat drop on side from height of 4 feet.

(3) Box No. 3. Flat drop on end from height of 4 feet.

(4) Box No. 4. Flat drop on top from height of 2 feet.

(b) Tests prescribed by paragraph (a) of this section must be conducted prior to initial use of the package and shall be repeated on the change of any components of the package.

11. Closing for shipment. (a) By any method capable or withstanding tests prescribed by para. 10.

12. Marking. (a) On each container. Symbol in rectangle as follows:

CTC-12A**

(1) Stars to be replaced by authorized gross weight (for example, CTC-12A75). The letters NRC, located just above or below the CTC mark, to indicate a nonreuseable container. These marks shall be understood to certify that the outer container complies with all the construction requirements of the specification.

(2) Name and address of plant making the containers; symbol (letters) authorized if recorded with the Bureau of Explosives through the Commission. This mark to be located just above or below the mark specified in (a) of this section.

(3) Size of markings: Specification markings prescribed in paragraph (a) (1) in paragraph 12 must be at least ½″ high; other markings must be legible.

Specification 12B

FIBREBOARD BOXES

1. Compliance. (a) Required in all details.

2. Definitions. (a) Terms such as "200-pound test" mean minimum strength Mullen or Cady test,

(b) "Joints" are where edges of parts of box, except recessed flanged heads, are connected together in setting up the box. Generally done by box marker.

(c) "Seams" are where edges of parts of box are visible, except joints, when box is closed.

3. Classification of board. (a) Fibreboard is hereby classified by strength[1] of completed board as in first column of the following table; weights specified in the table are the minimums authorized.

Classified strength[1] of completed board	Solid fibreboard—Minimum combined weight of component plies exclusive of adhesives (pounds per 1,000 sq. ft.)	Facings for corrugated fibreboard	
		Double-faced—Minimum combined weight of facings (pounds per 1,000 sq. ft.)	Double-wall-Minimum combined weight of facings including centre liner (pounds per 1,000 sq. ft.)
175	149	75	.....
200	190	84	92
275	237	138	110
325	237	138	110
250	283	180	126
375	283	180	180
400	283	180	180
450	283	180	180

[1] Mullen or Cady test (minimum).

4. Solid fibreboard. (a) To be 3-ply or more; both outer plies water resistant.

5. Corrugated fibreboard. (a) Both outer facings water resistant; corrugated sheets must be at least 0.009 inch thick and weigh not less than 26 pounds per 1,000 square feet; all parts must be securely glued together throughout all contact areas.

6. Stitching staples. (a) Stitching staples must be made in such a configuration that their holding capability as installed will not be less than that of flat steel staples $3/32 \times 0.019$ inch in cross section and not less than 7/16 inch wide.

7. Tape. (a) Coated with glue at least equal to No. 1¾ Peter Cooper standard. Cloth tape of strength, across the woof, at least 70 units, Elmendorf test. Sisal tape of 2 sheets of No. 1 Kraft paper, total weight 80 pounds per ream (500 sheets, 24″ × 36″); sheets to be combined with asphalt and reinforced by unspun sisal fibres completely embedded in the asphalt and extending across the tape, except as provided in paragraph 11(d). Other tapes of equal strength and efficiency are authorized.

(b) Tape for closure of slotted containers complying with the following requirements is authorized when applied as prescribed in paragraph 17(a)(3):

(1) Tape must be not less than 3 inches wide and shall be made of two sheets of 100 per cent sulfate Kraft each not less than 30 pounds basis weight, reinforced with glass, sisal, or rayon fibre, combined with a laminant of asphalt or other material not affected by temperature extremes any more than would an asphalt with a 180° to 200°F softening point.

(2) Tape must be reinforced by lengthwise fibres spaced not more than an average of ½ inch apart, and by crosswise fibres spaced not less than an average of 2 per inch except that when a diamond pattern is employed for crosswise reinforcement, the spacing between the parallel sides of the diamond measured in the machine direction must be not more than 1 inch.

(3) Glass or sisal reinforced tape must have a minimum tensile strength in the machine direction of 75 pounds per inch of width and a minimum tensile strength in the cross direction of 45 pounds per inch of width; rayon reinforced tape must have a minimum strength in the machine direction of 75 pounds per inch of width and a minimum tensile strength in the cross direction of 27 pounds per inch of width with elongation not exceeding 15 per cent. Tensile tests on the finished product shall be made on a 3-inch width sample.

8. Test. (a) Acceptable board must have prescribed strength, Mullen or Cady test, after exposure for at least 3 hours to normal atmospheric conditions (50 to 70 per cent relative humidity), under test as follows:

(1) Clamp board firmly in machine and turn wheel thereof at constant speed of approximately 2 revolutions per second.

(2) Six punctures required, 3 from each side; all results but one must show prescribed strength.

(3) Board failing may be retested by making 24 punctures, 12 from each side; when all results but 4 show prescribed strength the board is acceptable.

(4) For corrugated fibreboard, double-pop tests may be disregarded.

9. Types authorized. (a) To be of solid or corrugated fibreboard of the following types, or as specifically provided for in paras. 19 to 37.

(1) Slotted box; three-piece box without recessed ends; three-piece box of solid fibreboard with recessed ends; double-slide box; triple-slide box; telescope box, with sections of equal depth, or with covers, top or bottom or both, with 3 inches overlap. (See sec. 14(d) for boxes with single-flap closures).

10. Forming. (a) Parts must be cut true to size and so creased and slotted as to fit closely into position without cracking, surface breaks, separation of parts outside of crease, or undue binding.

11. Joints. (a) For solid and corrugated fibreboard slotted containers: Lapped 1½″ from centre of scoreline except as in paragraph 12; stitched at 2½″ intervals and within 1″ of each end of joint; body joint must be double-stitched (2 parallel stitches) at each end of joint over 18″ long.

(b) For corrugated fibreboard slotted containers only: One butt joint taped (see sec. 7) is authorized; 3 inch tape required for boxes over 30 pounds authorized gross weight and 2 inch tape for others.

(c) For triple and double slide boxes: Joints of all slides must be taped (see paragraph 7) or stitched; 3-inch tape required for boxes over 30 pounds authorized gross weight and 2-inch for others.

(d) For corrugated fibreboard only: One butt joint taped inside and outside with strips of one thickness of sulphate paper not less than 2 inches wide extending entire length of joint and firmly glued to box. For boxes not exceeding 65 pounds gross weight, outside strip of sulphate paper to be of basis weight not less than 60 pounds testing not less than 60 pounds and inside strip of sulphate paper to be of basis weight not less than 40 pounds testing not less than 40 pounds. For boxes exceeding 65 pounds gross weight, outside and inside with strips of sulphate paper which must each be of basis weight not less than 90 pounds testing not less than 90 pounds. Basis weight of paper shown is for 500 sheets, 24 × 36 inches.

(1) For glued lap joint, the sides of box forming joint must lap not less than 1¼″ and be firmly glued throughout entire area of contact with a glue or adhesive which cannot be dissolved in water after the film application has dried.

12. Flanged heads. (a) Must have 4 flanges, at least 1″ long above fillet, on each head. Recessed flanged heads not authorized for boxes of corrugated fibreboard.

13. Seams which are to be stitched. (a) Overlap, if any, required to be at least 1½″ from centre of scoreline except as in paragraph 12.

14. Flap closures. (a) Fill-in pieces, of the same type fibreboard as used in construction of the container, are required where it is necessary to prevent an opening between the inner flaps, unless otherwise provided by paragraphs (b) and (c) of this section or by Part 73.

(b) If to be closed by adhesive, each inner flap must cover at least ⅓ of face; inner flaps must butt or have full overlap, or fill-in pieces must be used, unless otherwise provided by Part 73, except that fill-in pieces are not required when outer flaps have full overlap. Outer flaps must butt or have full overlap.

(c) In lieu of fill-in pieces between inner flaps which do not butt, the following is authorized when linings are not prescribed in sec. 16:

(1) Top and bottom pads the same dimensions as interior of container of solid or corrugated fibreboard at least 125 pound test (Mullen or Cady).

(2) Minimum combined weight of facings for corrugated fibreboard pads must be at least 52 pounds per thousand square feet.

(3) Minimum combined weight of component plies for solid fibreboard pads must be at least 114 pounds per thousand square feet, exclusive of adhesives.

(4) Complete inner box or boxes.

(d) Single-flap closures are authorized for boxes with one dimension not over 2″; each flap must be scored and form one of the small faces of the box and lap at least 5″ on one of the largest faces.

15. Linings (when prescribed by para. 16). (a) Of 1 piece to extend around 4 faces with joint at centre of 1 face and with 4 flanges, at least 1½″ long, on each end (corners may be mitred) to bend over the other 2 faces; also 2 pads to cover the other 2 faces. Pads may be omitted if closing flaps afford 3 thicknesses throughout face. For boxes with 1 dimension not over 3″, one of the widest flanges may be lengthened to cover entire face and lap 6" on the adjoining face and the other flanges and the pads may then be omitted.

16. Authorized gross weight and parts required. (a) Authorized gross weight (when packed) and parts required as follows:

Authorized gross weight (pounds)	Strength of fibreboard (minimum) Mullen or Cady test						
	Solid board			Doubled-faced corrugated		Double-wall corrugated	
	Box	Lining[2]	Heads[1]	Box	Lining[2]	Box	Lining[1]
15	175		([2])	175		200	
30	200		275	200		200	
40	275		350	275		200	
				200	175		
55	325		([3])	325		275	
				375			
65[4]	375		([3])	275	175	275	
	275	175	350	200	200		

[1] For recessed heads when used. In other cases same as for box.

[2] As prescribed in sec. 15. A complete box is acceptable in place of the lining.

[3] Recessed heads not authorized in any case.

[4] Except as otherwise authorized herein or by Part 73.

(b) Triple slide boxes authorized for gross weights as follows: Of board at least 175-pound test for 40 pounds; of board at least 200-pound test for 65 pounds.

17. Closing for shipment. (a) Slotted container, by coating with adhesive the entire contact surfaces of closing flaps and fill-in pieces where required or as prescribed in subparagraphs (1), (2), or (3) of this paragraph.

(1) By stitching with staples as prescribed by paragraph 6 at 2½ in. intervals along all seams (one 5 in. space allowed when necessary to permit use of stitching device); or with staples made of flat wire of hardness not less than equivalent of Rockwell B90, and not less than .037 inch thick and not less than .074 inch wide, with not less than 1¼ inch crown, may be spaced not more than 5 inches apart. Such staples may be used across centre seam where outside flaps meet in lieu of on both sides of centre seam but need only be used where outside flaps overlay inner flaps; or staples made of arcuate wire of hardness not less than equivalent of Rockwell B90, and not less than .027 inch thick and not less than .095 inch wide, with not less than 1 inch crown, may be spaced not more than 5 inches apart. Such stitches when spaced not more than 2½ inches apart may be used across centre seam where outside flaps meet in lieu of on both sides of centre seam but need only be used where outside flaps overlay inner flaps.

(2) For fibreboard boxes containing not more than 1 inside metal can not exceed 1 gallon nominal capacity and as otherwise authorized by Part 73, by application of 2 strips of pressure-sensitive tape not less than ½ inch in width. 1 strip to be placed approximately equal distance over the seam abutting outer flaps, the other at a right angle to the first and spaced approximately equal distance on the closure face; strips must be of sufficient length to extend not less than 1 inch beyond score lines on side and end panels. Tape shall have a minimum tensile strength of 160 pounds per inch of width; minimum adhesion value of 18 ounces per inch of width; and minimum elongation of 12 per cent at break, or having a minimum longitudinal tensile strength of not less than 240 pounds per inch of width; minimum adhesion value of 18 ounces per inch of width and a minimum elongation of 3 per cent at break.

(3) For slotted containers only, reinforced tape complying with the requirements of paragraph 7(b) is authorized for application over the centre seam only. Tape must extend over the ends of box not less than 2½ inches

(b) Double slide boxes or triple slide boxes, by coating the inner slides with adhesive, or by closing with reinforced tape capable of withstanding test prescribed by subparagraph (1) of this paragraph; for single-flap closures as authorized for boxes with one dimension not over 2 inches, the flaps must be fastened to the body with adhesive.

(1) Boxes selected at random, containing dummy contents similar to that to be shipped and packed to authorized gross weight, closed with reinforced tape across the ends and onto opposite side panels at least 2 inches, must be capable of withstanding a drop on each end from a height of 4 feet onto solid concrete without closure failure.

(c) Fibreboard boxes with covers extending over sides but not to bottom, covers resting on walls of box, or telescope boxes of equal depth section, covers extending to bottom, must be secured by one of the following methods:

(1) By not less than three metal straps, one lengthwise and others at right angles thereto.

(2) When cover extends not less than 3″ over the walls of the box, by coating with adhesive the entire contact area of the cover.

(3) Telescope boxes having equal depth sections may be closed by application of reinforced water activated tape or pressure sensitive tape under conditions and for commodities as prescribed in these Regulations.

(d) When metal straps are specified, boxes must be strapped with the required number; size at least ⅝″ × 0.015″.

18. Marking. (a) On each container. Symbol in rectangle as follows:

CTC-12B**

(1) Stars to be replaced by authorized gross weight (for example, CTC-12B40, etc.). This mark shall be understood to certify that the container complies with all specification requirements.

(2) Name and address of plant making the container; symbol (letters) authorized if recorded with the Bureau of Explosives through the Commission. This mark to be located just above or below the mark specified in paragraph (a) of this section.

(3) When metal straps are prescribed, boxes must be marked "..... (number) METAL STRAPS REQUIRED" just above or below the mark specified in paragraph (a)(1) of this section.

(4) Size of markings: Specification markings prescribed in paragraph 18(a)(1) must be at least ½ in. high; other markings must be legible.

19. Special box; authorized only for contents in 1-gallon rectangular metal cans or cylindrical metal cans of 26-gauge material. (a) Must comply with this specification except as follows: Must be 1-piece type of double-wall corrugated fibreboard at least 400-pound test with all three facings at least 135-pound test; to be marked "FOR 1-GAL. CYLINDRICAL OR RECTANGULAR CANS ONLY" near the CTC specification mark; authorized gross weight 84 pounds.

20. Special box; authorized only for pyroxylin in sheets, rods, or tubes. (a) Must comply with this specification except as follows: Must be of board at least 275-pound test with lining at least 200-pound test, all being double-faced corrugated fibreboard; 3 metal straps required (see secs. 17 and 18); authorized gross weight 90 pounds.

21. Special box; authorized only for pyroxylin in sheets, rods, or tubes. (a) Must comply with this specification except as follows: Must be telescope type with wooden frame between the parts that telescope; authorized gross weight 90 pounds.

(b) Frame of group 3 or 4 wood 9/16″ thick with lock corners glued.

Group 3

White elm	Pumkin ash	Tupelo
Red gum	Black gum	Maple—soft or silver
Sycamore	Black ash	

Group 4

Hard maple	Hackberry	Hickory
Beech	Birch	White ash
Oak	Rock elm	

(c) Telescoping parts of double-faced corrugated fibreboard at least 400-pound test with facings at least 180 pounds per thousand square feet; each part of same depth as frame; outer part to have corners overlapped and securely fastened.

(d) Four metal straps required. Glued or stitched closure not required. (See secs. 17 and 18.)

22. Special box; authorized only for motion-picture film in metal cans or strong cardboard or fibreboard boxes each containing not over 2,000 feet (approx.) of film. (a) Must comply with this specification except as follows:

(1) For one inside container. Must be of board at least 275-pound test for a 2,000-foot film and of board at least 200-pound test for a 1,000-foot film; lining and pads not required; closure by taping with strong paper tape authorized.

(2) For more than one inside container. Must be of 1-piece type; authorized gross weight 55 pounds when made of 325-pound test board, 65 pounds when made of 375-pound test board, and 75 pounds when made of 450-pound test board; interior packing required of fibreboard at least 175-pound test, adequate to support inside containers in centre of outside container; lining and top and bottom pads not required.

23. Special box; authorized only for poisonous solids, class B, in 1-gallon metal cans. (a) Must comply with this specification except as follows: Must be 1-piece type, of double-wall corrugated fibreboard at least 400-pound test with all three facings at least 135-pound test; authorized gross weight 84 pounds.

24. Special box; authorized only for fusees. (a) Must comply with this specification except that the box must be constructed of double faced corrugated fibreboard at least 400-pound test or solid fibreboard of same strength. Lining and pads are not required. Authorized gross weight is 75 pounds. For fusees equipped with spikes, box-end protections as required in § 73.154a(a)(2) must be provided.

25. Special box; authorized only for wet electric storage batteries of the glass cell type or synthetic resin (plastic) type. (a) Must comply with this specification except as follows: Must be one-piece type of double-wall corrugated fibreboard at least 275-pound test; must have linings to extend around four faces with joint in centre of or at end of one face but at no time may joint of box and joint of liner coincide; lining to be of sufficient height to support vertical scorings of box; lining to be made of double-wall corrugated board with minimum test of 275 pounds, top of battery or batteries to be protected by trays or scored sheets of corrugated fibreboard having minimum test of 200 pounds; bottom of batteries to be protected by minimum of one excelsior pad or one double-wall corrugated fibreboard pad; when one or more batteries are packed in same carton, batteries must be separated by a minimum of one thickness of double-wall corrugated fibreboard having minimum test of 275 pounds; authorized gross weight 95 pounds.

26. Special box; authorized only for one 5-gallon rectangular metal can, spec. 2F; gross weight not to exceed 65

pounds. (a) Must comply with this specification except as follows: Must be 1-piece type of double-wall corrugated fibreboard at least 350-pound test; must have top and bottom pads of double-wall corrugated fibreboard at least 350-pound test, pads to be double-flanged with flanges extending down the inside of carton at least four inches.

27. Special box; authorized only for not more than two square inside metal cans each containing not over 200 feet (approx.) motion-picture film; gross weight not to exceed 15 pounds. (a) Must comply with this specification except as follows: Must be double-slide type, both slides of double-faced corrugated fibreboard at least 200-pound test; closure by taping with strong paper tape authorized.

28. Special box; authorized only for wet electric storage batteries of aluminum-case type, asphaltum composition impregnated rubber, synthetic resin (plastic), or wooden-battery-box type, having a net weight greater than 75 pounds. (a) Must comply with this specification except as follows: Must be one-piece type of double-wall corrugated fibreboard at least 400-pound test, or solid fibreboard testing at least 400 pounds; boxes may or may not have hand holes provided for in ends of box provided same will not materially weaken box; top of battery to be protected by wood frame, corrugated trays or scored sheets of corrugated fibreboard having minimum test of 200 pounds, top protection must bear evenly on connectors of battery to facilitate stacking of batteries; bottom of batteries to be protected by minimum of one excelsior pad or double-wall corrugated fibreboard pad; sides and ends to be cushioned between batteries and walls of box; combined thickness of cushioning material and walls of box must be not less than ½ inch cushioning to be of excelsior pads, corrugated fibreboard or other suitable cushioning material; no more than one battery to be packed per box, authorized gross weight 190 pounds.

29. Special box; authorized only for ship distress signals in inside metal containers of not less than 24-gauge metal. (a) Must comply with this specification except as follows: Must be one-piece type of double-faced corrugated board at least 350-pound test, with top and bottom pads of the same material. Gross weight not to exceed 95 pounds.

30. Special box; authorized only for toy torpedoes. (a) Must comply with this specification and the following: Must be one-piece type fabricated of double-wall corrugated fibreboard having minimum strength of 350 pounds per square inch, Mullen or Cady test. Box shall be provided with double-face lining on all sides and top and bottom pads. Gross weight not to exceed 25 pounds.

31. Special box; authorized only for commodities where spec. 12B is prescribed in Part 73. (a) Box shall have not more than 1 inside glass container having screw cap closure or metal container not exceeding 32 ounces or 2 pounds net weight, which must fit snugly or be adequately cushioned to prevent movement. Box shall comply with this specification and be of one-piece folder type, so designed as to form double thickness of corrugated board on top, bottom, and ends. Fibreboard used in construction of the box shall have a minimum strength of 200 pounds per square inch, but for gross weight exceeding 8 pounds, the box must be constructed of at least 275-pound per square inch test fibreboard (Mullen or Cady). Closure must be equal in efficiency to that prescribed in paragraph 17.

32. Special box; authorized only for electrolyte (acid), corrosive battery fluid, or hydrochloric acid mixtures of not over 28 per cent strength, or cleaning compounds, liquid, containing not over 28 per cent hydrochloric (muriatic) acid. (a) Box shall have not more than 12 inside glass bottles, with acid-proof closures, of not over 32 ounces capacity each. Box shall comply with this specification and be constructed of at least 275-pound test (Mullen or Cady) double-wall corrugated fibreboard and be equipped with at least 125-pound test (Mullen or Cady) double-faced corrugated fibreboard scored sheets so designed as to provide two thicknesses of corrugated fibreboard between each bottle and one thickness between bottles and sides and ends of box. Top and bottom pads of the same size as the top and bottom area of the box and of at least 125-pound test (Mullen or Cady) double-faced corrugated board are required or box shall comply with this specification and be constructed of at least 325-pound test (Mullen or Cady) double-faced corrugated board and be equipped with at least 200-pound test (Mullen or Cady) corrugated fibreboard ½ inch extended cell slotted partitions so designed as to provide a void space between the ends and sides of outside box and the inside cell partition and shall be provided with top and bottom pads, of the same area as the box, of at least 200-pound test (Mullen or Cady) double-faced corrugated fibreboard.

33. Special box; authorized only for electrolyte (acid) and alkaline corrosive battery fluid packed with storage batteries. (a) Box shall be constructed of corrugated fibreboard having strength of not less than 200 pounds per square inch, Mullen or Cady test for maximum authorized gross weight not over 65 pounds. Top and bottom pads and fill-in pieces are not required when inner flaps do not meet. Box must otherwise comply with this specification. (See § 73.258(a)(3)).

34. Special box; authorized only for a polyethylene, or other suitable plastic, tight-fitting inside container having a minimum wall thickness of 0.015 inch and so designed as to maintain its configuration when standing empty and open. (a) Box shall comply with this specification except that top of box shall be closed by means of slotted flaps so arranged as to provide protection for the neck of the inside container and be fitted with fill-in pieces as necessary. Complete package, closed as for shipment, with inside container filled to rated capacity with water, must be capable of withstanding 2 drops from a height of 4 feet onto solid concrete without leakage or serious rupture of box. Authorized gross weight not over 65 pounds.

35. Special box; authorized only for aircraft type wet electric storage batteries. (a) Box shall comply with this specification and shall be constructed of at least 275-pound test double-faced corrugated fibreboard. Inside corrugated fibreboard cushioning shall be provided as necessary to prevent short-circuits, breakage under normal conditions of transportation, and superimposed weights on links, covers, or other parts weaker than the battery case. Not more than one wet electric storage battery shall be packed in a box and gross weight shall not exceed 85 pounds.

36. Special box; authorized only for an inside polyethylene container, spec. CTC-2U, not over 5 gallons capacity.

(a) Box shall comply with this specification except as provided herein, and shall have glued closure flaps only. Inner and outer top closure flaps may have suitably sized holes for access to the closure of the polyethylene container. The diameter of these holes must be less than the diameter of a metal plate inserted between the flaps to which polyethylene closure shall be attached.

37. Special box; authorized polyethylene or other suitable plastic bags for packaging of electrolyte (acid) or alkaline corrosive battery fluid only. (a) Box must comply with this specification except as follows: Box must be one-piece construction of slotted style and may have die-cut areas of minimum size to provide access to an inside closure part. Box must contain one multi-wall bag made of polyethylene or other suitable plastic of sufficient size and capacity to be capable of coming into contact with all of the interior surface of the box when filled. Each ply of the bag must be formed from virgin film not less than 0.003 inch thick. Joints must be heat sealed and not less than ⅛-inch wide.

(b) Boxes must be centre special slotted style, or regular slotted style. If any metal is used in the box construction, full liners and top and bottom pads are required. Any metal closure for a discharge tube must be installed so as to prevent contact with the polyethylene bag. Discharge tubes must be plugged or heat sealed. Maximum volumetric capacity must not exceed 4 gallons (nominal).

(1) For boxes having capacities of 5 quarts (nominal) or less, fibreboard of at least 200-pound test is required for construction.

(2) For boxes having capacities in excess of 5 quarts, fibreboard of at least 350-pound test is required. Pads are required for regular slotted style boxes and must be of fibreboard of at least 350-pound test or other material that will provide equivalent protection.

(c) Representative samples of completely assembled boxes, with all parts closed as for shipment, must be capable of withstanding the following tests without leakage or serious damage to boxes. No one box shall be expected to withstand more than one of the following tests:

(1) Box with inside container filled to shipping capacity with a solution which is compatible with the plastic bags must be dropped twice from a height of 4 feet onto concrete, one drop to be made with the box positioned so as to strike flat on the box bottom, the other drop to be made so box will strike flat on the largest face.

(2) Box with inside container filled to shipping capacity with a solution which is compatible with the plastic bags, and remains liquid at 0°F. or lower shall be dropped once from a height of 4 feet onto concrete, when container and contents are at or below 0°F. Box shall be positioned so as to strike flat on the box bottom.

(3) Box with inside container filled as prescribed in paragraph (c)(1) of this section shall be capable of withstanding a vibration test by placing the container on the vibration table anchored in such manner that all horizontal motion shall be restricted and only vertical motion allowed. The test shall be performed for one hour using an amplitude of one inch at a frequency that causes the test container to be raised from the floor of the table to such a degree that a piece of paper or flat steel strap or tape can be passed between the table and the container.

(d) Tests to be conducted by or for each plant assembling and filling boxes at the initial start of production and must be repeated at intervals of four months thereafter; initial tests must be witnessed by a representative of the Commission or Bureau of Explosives. Samples last tested must be dated with date of test and must be retained until subsequent tests are conducted. Empty boxes with liners may be shipped to a central point for assembling, filling and testing in which case the Commission must be advised of test location.

Specification 12C

FIBREBOARD BOXES

1. Compliance. (a) Required in all details.

2. Definitions. (a) Terms such as "200-pound test" mean minimum strength, Mullen or Cady test.

(b) "Joints" are where edges of parts of box, except recessed flanged heads, are connected together in setting up the box. Generally done by box maker.

(c) "Seams" are where edges of parts of box are visible, except joints, when box is closed.

3. Classification of board. (a) Fibreboard is hereby classified by strength of completed board as in first column of the following table; weights specified in the table are the minimums authorized.

Classified strength[1] of completed board	Solid fibreboard—Minimum combined weight of component plies exclusive of adhesives (pounds per 1,000 sq. ft.)	Facings for corrugated fibreboard	
		Double-faced—Minimum combined weight of facings (pounds per 1,000 sq. ft.)	Double-wall—Minimum combined weight of facings including centre liner (pounds per 1,000 sq. ft.)
175	149	75	.....
200	190	84	92
275	237	138	110
350	283	180	126

[1] Mullen or Cady test (minimum).

4. Solid fibreboard. (a) To be 3-ply or more; both outer plies water resistant.

5. Corrugated fibreboard. (a) Both outer facings water resistant; corrugated sheets must be at least 0.009 inch thick and weigh not less than 26 pounds per 1,000 square feet; all parts must be securely glued together throughout all contact areas.

6. Stitching staples. (a) Stitching staples must be made in such a configuration that their holding capability as installed will not be less than that of flat steel staples 3/32 × 0.019 inch in cross section and not less than 7/16 inch wide.

7. Tape. (a) Coated with glue at least equal to No. 1¾ Peter Cooper standard. Cloth tape of strength, across woof, at least 70 units, Elmendorf test. Sisal tape of 2 sheets of No. 1 Kraft paper, total weight 80 pounds per ream (500 sheets, 24 × 36 inches); sheets to be combined with asphalt and reinforced by unspun sisal fibres completely embedded in the asphalt and extending across the tape, except as provided in sec. 11(d).

(b) Tape for closure of slotted containers complying with the following requirements is authorized when applied as prescribed in para. 17(a)(3):

(1) Tape must be not less than 3 inches wide and shall be made of two sheets of 100 per cent sulphate Kraft each not less than 30 pounds basis weight, reinforced with glass, sisal, or rayon fibre, combined with a laminant of asphalt or other material not affected by temperature extremes any more than would an asphalt with a 180° to 200°F softening point.

(2) Tape must be reinforced by lengthwise fibres spaced not more than an average of ½ inch apart, and by crosswise fibres spaced not less than an average of 2 per inch except that when a diamond pattern is employed for crosswise reinforcement, the spacing between the parallel sides of the diamond measured in the machine direction must be not more than 1 inch.

(3) Glass or sisal reinforced tape must have a minimum tensile strength in the machine direction of 75 pounds per inch of width and a minimum tensile strength in the cross direction of 45 pounds per inch of width; rayon reinforced tape must have a minimum tensile strength in the machine direction of 75 pounds per inch of width and a minimum tensile strength in the cross direction of 27 pounds per inch of width with elongation not exceeding 15 per cent. Tensile tests on the finished product shall be made on a 3-inch width sample.

8. Test. (a) Acceptable board must have prescribed strength, Mullen or Cady test, after exposure for at least 3 hours to normal atmospheric conditions (50 to 70 per cent relative humidity), under test as follows:

(1) Clamp board firmly in machine and turn wheel thereof at constant speed of approximately 2 revolutions per second.

(2) Six punctures required, 3 from each side; all results but one must show prescribed strength.

(3) Board failing may be retested by making 24 punctures, 12 from each side; when all results but 4 show prescribed strength the board is acceptable.

(4) For corrugated fibreboard, double-pop tests may be disregarded.

9. Types authorized. (a) To be of solid or corrugated fibreboard of the following types:

(1) Slotted box; three-piece box without recessed ends; three-piece box of solid fibreboard with recessed ends; double-slide box; triple-slide box; telescope box, with sections of equal depth, or with covers, top or bottom or both, with 3-inch overlap. (See sec. 14(d) for boxes with single-flap closures).

10. Forming. (a) Parts must be cut true to size and so creased and slotted as to fit closely into position without cracking, surface breaks, separation of parts outside of crease, or undue binding.

11. Joints. (a) For solid and corrugated fibreboard slotted containers; Lapped 1½″ from centre of scoreline except as in paragraph 12; stitched at 2½″ intervals and within 1″ of each end of joint; body joint must be double-stitched (2 parallel stitches) at each end of joint over 18″ long.

(b) For corrugated fibreboard slotted containers only: One butt joint taped (see sec. 7) is authorized; 3 inch tape required for boxes over 30 pounds authorized gross weight and 2 inch tape for others.

(c) For triple and double-slide boxes; Joints of all slides must be taped (see sec. 7) or stitched.

(d) For corrugated fibreboard only: One butt joint taped inside and outside with strips of one thickness of sulphate paper not less than 2 inches wide extending entire length of joint and firmly glued to box. For boxes not exceeding 65 pounds gross weight, outside strip of sulphate paper to be of basis weight not less than 60 pounds testing not less than 60 pounds and inside strip of sulphate paper to be of basis weight not less than 40 pounds testing not less than 40 pounds. For boxes exceeding 65 pounds gross weight, outside and inside with strips of sulphate paper which must each be of basis weight not less than 90 pounds testing not less than 90 pounds. Basis weight of paper shown is 500 sheets, 24 × 36 inches.

(1) For glued lap joint, the sides of box forming joint must lap not less than 1¼″ and be firmly glued throughout entire area of contact with a glue or adhesive which cannot be dissolved in water after the film application has dried.

12. Flanged heads. (a) Must have 4 flanges, at least 1″ long above fillet, on each head. Recessed flanged heads not authorized for boxes of corrugated fibreboard.

13. Seams which are to be stitched. (a) Overlap, if any, required to be at least 1½″ from centre of scoreline except as in paragraph 12.

14. Flap closures. (a) Fill-in pieces, of the same type fibreboard as used in construction of the container, are required where it is necessary to prevent an opening between the inner flaps, unless otherwise provided by Part 73.

(b) If to be closed by adhesive, each inner flap must cover at least ⅓ of face; inner flaps must butt or have full overlap, or fill-in pieces must be used, unless otherwise provided by Part 73, except that fill-in pieces are not required when outer flaps have full overlap. Outer flaps must be reasonably close together at the centre seam or have full overlap.

(c) In lieu of fill-in pieces between inner flaps which do not butt, the following is authorized when linings are not prescribed in sec. 16:

(1) Top and bottom pads the same dimensions as interior of container of solid or corrugated fibreboard at least 125 pound test (Mullen or Cady).

(2) Minimum combined weight of facings for corrugated fibreboard pads must be at least 52 pounds per thousand square feet.

(3) Minimum combined weight of component plies for solid fibreboard pads must be at least 114 pounds per thousand square feet, exclusive of adhesives.

(4) Complete inner box or boxes.

(d) Single-flap closures are authorized for boxes with one dimension not over 2″; each flap must be scored and form one of the small faces of the box and lap at least 5″ on one of the largest faces.

15. Linings (when prescribed). (a) Of 1 piece to extend around 4 faces with joint at centre of 1 face and with 4 flanges, at least 1½″ long, on each end (corners may be mitred) to bend over the other 2 faces; also 2 pads to cover the other 2 faces. Pads may be omitted if closing flaps afford 3 thicknesses throughout face. For boxes with 1 dimension not over 3″, one of the widest flanges may be lengthened to cover entire face and lap 6″ on the adjoining face and the other flanges and the pads may then be omitted.

16. Authorized gross weight and parts required. (a) Authorized gross weight (when packed) and parts required as follows:

Authorized gross weight (pounds)	Strength of fibreboard (minimum) Mullen or Cady test						
	Solid board			Double-faced corrugated		Double-wall corrugated	
	Box	Lining[3]	Heads[1]	Box	Lining[2]	Box	Lining[3]
30	175		200	175		200	
40	200		275	200		200	
				[3]275			
65[4]	275		350	200	175	275	

[1] For recessed heads when used. In other cases same as for box.

[2] As prescribed in sec. 15. A complete box is acceptable in place of the lining.

[3] Facings at least 138 pounds per thousand square feet or inner facing at least 42 pounds and outer facing at least 90 pounds per thousand square feet.

[4] Except as otherwise authorized by Part 73.

(b) Triple-slide boxes of double-faced corrugated fibreboard of at least 175-pound test are also authorized for 65 pounds gross weight.

17. Closing for shipment. (a) Slotted container, by coating with adhesive the entire contact surfaces of closing flaps and fill-in pieces where required or as prescribed in subparagraphs (1), (2), or (3) of this paragraph.

(1) By stitching with staples as prescribed by paragraph 6 at 2½ in. intervals along all seams (one 5 in. space allowed when necessary to permit use of stitching device); or with staples made of flat wire of hardness not less than equivalent of Rockwell B90, and not less than .037 inch thick and not less than .074 inch wide, with not less than 1¼ inch crown, may be spaced not more than 5 inches apart. Such staples may be used across centre seam where outside flaps meet in lieu of on both sides of centre seam but need only be used where outside flaps overlay inner flaps; or staples made of arcuate wire of hardness not less than equivalent of Rockwell B90, and not less than .027 inch thick and not less than .095 inch wide, with not less than 1 inch crown, may be spaced not more than 5 inches apart. Such stitches when spaced not more than 2½ inches apart may be used across centre seam where outside flaps meet in lieu of on both sides of centre seam but need only be used where outside flaps overlay inner flaps.

(2) For fibreboard boxes containing not more than 1 inside metal can not exceeding 1 gallon nominal capacity, by application of 2 strips of pressure-sensitive tape not less than ½ inch in width, 1 strip to be placed approximately equal distance over the seam of abutting outer flaps, the other at a right angle to the first and spaced approximately equal distance on the closure face; strips must be of sufficient length to extend not less than 1 inch beyond score lines on side and end panels. Tape shall have a minimum tensile strength of 160 pounds per inch of width; minimum adhesion value of 18 ounces per inch of width; and minimum elongation of 12 per cent at break, or having a minimum longitudinal tensile strength of not less than 240 pounds per inch of width; minimum adhesion value of 18 ounces per inch of width and a minimum elongation of 3 per cent at break.

(3) For slotted containers only, reinforced tape complying with the requirements of paragraph 7(b) is authorized for application over the centre seam only. Tape must extend over the ends of box not less than 2½ inches.

(b) Double-slide boxes or triple-slide boxes, by coating with adhesive the inner slides; for single-flap closures as authorized for boxes with one dimension not over 2″, the flaps must be fastened to the body with adhesive.

(c) Fibreboard boxes with covers extending over sides but not to bottom, covers resting on walls of box, or telescope boxes of equal depth section, covers extending to bottom, must be secured by one of the following methods:

(1) By not less than three metal straps, one lengthwise and others at right angles thereto.

(2) When cover extends not less than 3″ over the walls of the box, by coating with adhesive the entire contact area of the cover.

(d) When metal straps are specified, boxes must be strapped with the required number; size at least ⅝″ × 0.015″.

18. Marking. On each container. Symbol in rectangle as follows:

CTC-12C***

(1) Stars to be replaced by authorized gross weight (for example, CTC-12C65, etc.). This mark shall be understood to certify that the container complies with all specification requirements.

(2) Name and address of plant making the container; symbol (letters) authorized if recorded with the Bureau of Explosives through the Commission. This mark to be located just above or below the mark specified in paragraph (a) of this section.

(3) When metal straps are prescribed, boxes must be marked "……(number) METAL STRAPS REQUIRED" just above or below the mark specified in (a)(1) of this section.

(4) Size of markings: Specification markings prescribed in paragraph 18 (a)(1) must be at least ½ in. high; other markings must be legible.

19. Special box; authorized only for polyethylene, or other suitable plastic, tight-fitting inside containers having

minimum wall thickness of 0.015 inch and so designed as to maintain their configuration when standing empty and open. (a) Box shall comply with this specification except that top of box shall be closed by means of slotted flaps so arranged as to provide protection for the neck of the inside container and be fitted with fill-in pieces as necessary. Top may have die-cut area of suitable size to provide for easy opening. Complete package, closed as for shipment, with inside container filled to rated capacity with water, must be capable of withstanding 2 drops from a height of 4 feet onto solid concrete without leakage or serious rupture of box. Authorized gross weight not over 65 pounds. (See § 73.257(a)(6).

Specification 12D

FIBREBOARD BOXES

1. Compliance. (a) Required in all details.

2. Definitions. (a) Terms such as "200-pound test" mean minimum strength, Mullen or Cady test.

(b) "Joints" are where edges of parts of box are connected together in setting up the box. Generally done by box maker.

(c) "Seams" are where edges of parts of box are visible, except joints, when box is closed.

3. Classification of board. (a) Fibreboard is hereby classified by strength of completed board as in first column of the following table; weights specified in the table are the minimums authorized.

Classified strength[4] of completed board	Facings for double-wall corrugated fibreboard—Minimum combined weight of facings including centre liner (pounds per 1,000 sq. ft.)
275	110
350	126

[4] Mullen or Cady test (minimum).

4. Corrugated fibreboard. (a) Both outer facings water resistant; corrugated sheets at least 0.009″ thick and weigh not less than 26 pounds per 1,000 square feet; all parts securely glued together throughout all contact areas.

5. Stitching staples. (a) Stitching staples must be made in such a configuration that their holding capability as installed will not be less than that of flat steel staples 3/32 × 0.019 inch in cross section and not less than 7/14 inch wide.

6. Tape. (a) Coated with glue at least equal to No. 1¾ Peter Cooper standard. Cloth tape of strength, across the woof, at least 70 units, Elmendorf test. Sisal tape of 2 sheets of No. 1 Kraft paper, total weight 80 pounds per ream (500 sheets, 24″ × 36″); sheets to be combined with asphalt and reinforced by unspun sisal fibres completely embedded in the asphalt and extending across the tape, except as provided in sec. 10(d).

(b) Tape for closure of slotted containers complying with the following requirements is authorized when applied as prescribed in 17(a)(3);

(1) Tape must be not less than 3 inches wide and shall be made of two sheets of 100 per cent sulphate Kraft each not less than 30 pounds basis weight, reinforced with glass, sisal, or rayon fibre, combined with a laminant of asphalt or other material not affected by temperature extremes any more than would an asphalt with a 180° to 200°F softening point.

(2) Tape must be reinforced by lengthwise fibres spaced not more than an average of ½ inch apart, and by crosswise fibres spaced not less than an average of 2 per inch except that when a diamond pattern is employed for crosswise reinforcement, the spacing between the parallel sides of the diamond measured in the machine direction must be not more than 1 inch.

(3) Glass or sisal reinforced tape must have a minimum tensile strength in the machine direction of 75 pounds per inch of width and a minimum tensile strength in the cross direction of 45 pounds per inch of width; rayon reinforced tape must have a minimum tensile strength in the machine direction of 75 pounds per inch of width and a minimum tensile strength in the cross direction of 27 pounds per inch of width with elongation not exceeding 15 per cent. Tensile tests on the finished product shall be made on a 3-inch width sample.

7. Test. (a) Acceptable board must have prescribed strength, Mullen or Cady test, after exposure for at least 3 hours to normal atmospheric conditions (50 to 70 per cent relative humidity), under test as follows:

(1) Clamp board firmly in machine and turn wheel thereof at constant speed of approximately 2 revolutions per second.

(2) Six punctures required, 3 from each side; all results but one must show prescribed strength.

(3) Board failing may be retested by making 24 punctures, 12 from each side, when all results but 4 show prescribed strength the board is acceptable.

(4) Double-pop tests may be disregarded.

8. Types authorized. (a) To be of double-wall corrugated fibreboard of the following types:

(1) Slotted box; three-piece box without recessed ends; double-slide box; triple-slide box; telescope box, with sections of equal depth, or with covers, top or bottom or both, with 3 inch overlap.

9. Forming. (a) Parts must be cut true to size and so creased and slotted as to fit closely into position without cracking, surface breaks, separation of parts outside of crease, or undue binding.

10. Joints. (a) For slotted containers: Lapped 1½″ from centre of scoreline except as in paragraph 11; stitched at 2½″ intervals and within 1″ of each end of joint; body joint must be double-stitched (2 parallel stitches) at each end of joint over 18″ long.

(b) For slotted containers only: One butt joint taped (see sec. 6) is authorized; 3 inch tape required.

(c) For triple and double-slide boxes: Joints of all slides must be taped (see sec. 6) or stitched.

(d) One butt joint taped inside and outside with strips of one thickness of sulphate paper not less than 2 inches wide extending entire length of joint and firmly glued to box. For boxes not exceeding 85 pounds gross weight, outside strip of sulphate paper to be of basis weight not less than 60 pounds testing not less than 60 pounds and inside strip of sulphate paper to be of basis weight not less than 40 pounds testing not less than 40 pounds. For boxes exceeding 65 pounds gross weight, outside and inside with strips of sulphate paper which must each be of basis weight not less than 90 pounds testing not less than 90 pounds. Basis weight of paper shown is for 500 sheets, 24 × 36 inches.

(1) For glued lap joint, the sides of box forming joint must lap not less than 1¼″ and be firmly glued throughout entire area of contact with a glue or adhesive which cannot be dissolved in water after the film application has dried.

11. Flanged heads. (a) Must have 4 flanges, at least 1″ long above fillet, on each head. Recessed flanged heads not authorized.

12. Seams which are to be stitched. (a) Overlap, if any, required to be at least 1½″ from centre of scoreline except as in paragraph 11.

13. Flap closures. (a) Fill-in pieces, of the same type fibreboard as used in construction of the container, are required where it is necessary to prevent an opening between the inner flaps.

(b) If to be closed by adhesive, each inner flap must cover at least ⅛ of face; inner flaps must butt or have full overlap, or fill-in pieces must be used; except that fill-in pieces are not required when outer flaps have full overlap. Outer flaps must butt or have full overlap.

14. Linings (when prescribed). (a) Of 1 piece to extend around 4 faces with joint at centre of 1 face and with 4 flanges, at least 1½″ long, on each end (corners may be mitred) to bend over the other 2 faces; also 2 pads to cover the other 2 faces. Pads may be omitted if closing flaps afford 3 thicknesses throughout face. For boxes with 1 dimension not over 3″, one of the widest flanges may be lengthened to cover entire face and lap 6″ on the adjoining face and the other flanges and the pads may then be omitted.

15. Authorized gross weight and parts required. (a) Authorized gross weight (when packed) and parts required as follows:

(1) For authorized gross weight not over 25 pounds, box must be constructed of at least 275-pound test corrugated fibreboard with liners and top and bottom pads, or a complete inner box, of same material.

(2) For authorized gross weight over 25 pounds but not exceeding 75 pounds, inside containers must be packed in boxes of at least 275-pound test corrugated fibreboard and these packages packed in an outside box of at least 350-pound test corrugated fibreboard.

16. Test for completed package. (a) The completed packages closed as for shipment must be capable of withstanding a drop of 4 feet to solid concrete without breakage of the inside containers.

17. Closing for shipment. (a) Slotted container, by coating with adhesive the entire contact surfaces of closing flaps and fill-in pieces, or as prescribed in subparagraphs (1) or (2) of this section.

(1) By stitching at 2½″ intervals along all seams (one 5″ space allowed when necessary to permit use of stitching device).

(2) For fibreboard boxes containing not more than 1 inside metal can not exceeding 1 gallon nominal capacity, by application of 2 strips of pressure-sensitive tape not less than ½ inch in width, 1 strip to be placed approximately equal distance over the seam of abutting outer flaps, the other at a right angle to the first and spaced approximately equal distance on the closure face; strips must be of sufficient length to extend not less than 1 inch beyond score lines on side and end panels. Tape shall have a minimum tensile strength of 160 pounds per inch of width; minimum adhesion value of 18 ounces per inch of width; and minimum elongation of 12 per cent at break, or having a minimum longitudinal tensile strength of not less than 240 pounds per inch of width; minimum adhesion value of 18 ounces per inch of width and a minimum elongation of 3 per cent at break.

(3) For slotted containers only, reinforced tape complying with the requirements of paragraph 6(b) is authorized for application over the centre seam only. Tape must extend over the ends of box not less than 2½ inches.

(b) Double-slide boxes or triple-slide boxes, by coating with adhesive the inner slides; for single-flap closures as authorized for boxes with one dimension not over 2″, the flaps must be fastened to the body with adhesive.

(c) Fibreboard boxes with covers extending over sides but not to bottom, covers resting on walls of box, or telescope boxes of equal depth section, covers extending to bottom, must be secured by one of the following methods:

(1) By not less than three metal straps, one lengthwise and others at right angles thereto.

(2) When cover extends not less than 3″ over the walls of the box, by coating with adhesive the entire contact area of the cover.

(d) When metal straps are specified, boxes must be strapped with the required number; size at least ⅝″ × 0.015″.

18. Marking. (a) On each container. Symbol in rectangle as follows:

CTC-12D***

(1) Stars to be replaced by authorized gross weight (for example, CTC-12D65, etc.). This mark shall be understood to certify that the container complies with all specification requirements.

(2) Name and address of plant making the container; symbol (letters) authorized if recorded with the Bureau of Explosives through the Commission. This mark to be located just above or below the mark specified in (a) of this section.

(3) When metal straps are prescribed, boxes must be marked "..... (number) METAL STRAPS REQUIRED" just above or below the mark specified in paragraph (a)(1) of this section.

(4) Size of markings: Specification markings prescribed in paragraph (a)(1) in paragraph 18 must be at least ½ in. high; other markings must be legible.

Specification 12E

FIBREBOARD BOXES

1. Compliance. (a) Required in all details.

2. Definitions. (a) Terms such as "200-pound test" mean minimum strength, Mullen or Cady test.

(b) "Joints" are where edges of parts of box, except recessed flanged heads, are connected together in setting up the box. Generally done by box maker.

(c) "Seams" are where edges of parts of box are visible, except joints, when box is closed.

3. Corrugated fibreboard. (a) Both outer facings water resistant; corrugated sheets must be at least 0.009 inch thick and weigh not less than 26 pounds per 1,000 square feet; all parts must be securely glued together throughout all contact areas.

4. Tape. (a) Coated with glue at least equal to No. 1¾ Peter Cooper standard. Cloth tape of strength, across woof, at least 70 units, Elmendorf test. Sisal tape of 2 sheets of No. 1 Kraft paper, total weight 80 pounds per ream (500 sheets, 24 × 36 inches); sheets to be combined with asphalt and reinforced by unspun sisal fibres completely embedded in the asphalt and extending across the tape.

5. Test. (a) Acceptable board must have prescribed strength, Mullen or Cady test, after exposure for at least 3 hours to normal atmospheric conditions (50 to 70 per cent relative humidity), under test as follows:

(1) Clamp board firmly in machine and turn wheel thereof at constant speed of approximately 2 revolutions per second.

(2) Six punctures required, 3 from each side; all results but one must show prescribed strength.

(3) Board failing may be retested by making 24 punctures, 12 from each side; when all results but 4 show prescribed strength the board is acceptable.

(4) Double-pop tests may be disregarded.

6. Type authorized. (a) Corrugated fibreboard with one-piece body with separate flanged heads. Box is authorized only for 1 or 2 rectangular metal inside containers of not over 5 gallons capacity each.

7. Forming. (a) Parts must be cut true to size and so creased and slotted as to fit closely into position without cracking, surface breaks, separation of parts outside of crease, or undue binding.

8. Joints. (a) Body. Each end of body must have four flanges, creased to bend over outside of body, at least 2½″ long beyond crease.

(b) Butt joint. One butt joint taped is authorized; 3-inch tape required.

9. Flanged heads. (a) Each head must have four flanges, one on each edge, creased to bend over outside body of the box and then under the body flanges, of length at least 5 inches exclusive of creases.

10. Authorized gross weight (when packed) and parts required. (a) Board for outside container must be corrugated fibreboard at least 400-pound test; minimum combined weight of component plies, exclusive of adhesives, 180 pounds per 1,000 square feet; body must be double-wall board; heads may be double-faced board. Authorized gross weight 110 pounds.

11. Closing for shipment. (a) Boxes must be closed by applying heads with head-flanges tucked under body-flanges and then fastening each head in place with a flat steel strap, at least ⅜″ × 0.015″, extending around the 4 sides of the body and securely sealed.

12. Marking. (a) On each container. Symbol in rectangle as follows:

CTC-12E110

(1) This mark shall be understood to certify that the container complies with all specification requirements.

(2) Name and address of plant making the container; symbol (letters) authorized if recorded with the Bureau of Explosives through the Canadian Transport Commission. This mark to be located just above or below the mark specified in paragraph (a) of this section.

(3) When metal straps are prescribed, boxes must be marked "..... (number) METAL STRAPS REQUIRED" just above or below the mark specified in paragraph (a)(1) of this section.

(4) Size of markings: Specification markings prescribed in paragraph 12(a)(1) must be at least ½ in. high; other markings must be legible.

Specification 12H

FIBREBOARD BOXES

1. Compliance. (a) Required in all details.

2. Definitions. (a) Terms such as "200-pound test" mean minimum strength Mullen or Cady test.

(b) "Joints" are where edges of parts of box are connected together in setting up the box. Generally done by box maker.

(c) "Seams" are where edges of parts of box are visible, except joints, when box is closed.

3. Classification of board. (a) Fibreboard is hereby classified by strength[1] of completed board as in first column of the following table; weights specified in the table are the minimum authorized.

Classified strength[1] of completed board	Facings for corrugated fibreboard	
	Double-faced—Minimum combined weight of facings (pounds per 1,000 sq. ft.)	Double-wall—Minimum combined weight of facings including centre liner (pounds per 1,000 sq. ft.)
275	138	110
325	138	110
350	180	126
375	180	180
400	180	180
450	180	180

[1] Mullen or Cady test (minimum).

4. Corrugated fibreboard. (a) Both outer facings water resistant; corrugated sheets must be at least 0.009 inch thick and weigh not less than 26 pounds per 1000 square feet; all parts must be securely glued together throughout all contact areas.

5. Stitching staples. (a) Stitching staples must be made in such a configuration that their holding capability as installed will not be less than that of flat steel staples $1/32 \times 0.019$ inch in cross section and not less than 7/16 inch wide. Material used must be at least equivalent to copper coated steel in non-sparking quality.

6. Tape. (a) Used for manufacturers' joints must be coated with glue at least equal to No. 1¾ Peter Cooper standard. Cloth tape of strength, across the woof, at least 70 units, Elmendorf test. Sisal tape of 2 sheets of No. 1 Kraft paper, total weight 80 pounds per ream (500 sheets, 24″ × 36″); sheets to be combined with asphalt and reinforced by unspun sisal fibres completely embedded in the asphalt and extending across the tape.

7. Test. (a) Acceptable board must have prescribed strength, Mullen or Cady test, after exposure for at least 3 hours to normal atmospheric conditions (50 to 70 per cent relative humidity), under test as follows:

(1) Clamp board firmly in machine and turn wheel thereof at constant speed of approximately 2 revolutions per second.

(2) Six punctures required, 3 from each side; all results but one must show prescribed strength.

(3) Board failing may be retested by making 24 punctures, 12 from each side; when all results but 4 show prescribed strength, the board is acceptable.

(4) For corrugated fibreboard, double-pop tests may be disregarded.

8. Type authorized. (a) Shall be corrugated fibreboard, telescoping type, 1-piece, 2-piece or 3-piece construction without recessed heads, as follows:

(1) Box to consist of top and bottom sections divided equally or unequally and inner lining tube. The lining tube must be staple stitched to the lower section of the box to give in effect a 2-piece box. (See paragraph 11).

(2) Box to consist of full depth top and bottom sections completely telescoping. No inner lining tube required. Three variations are authorized: one with bottom slotted on ends and cover on sides; second, with both cover and bottom slotted on sides; and third, with sides and ends (both covers and bottom) not slotted, manufacturer's joint a side lap glued or stapled to end, closing flaps to form top and bottom of box with side closing flaps out and overlapping.

NOTE 1: Hand-holes oval in shape, not more than 1 inch in width by 3 inches in length, and horizontal with top score line, are authorized in ends of top section of boxes.

(3) Box to consist of 1-piece or 3-piece, without recessed heads, fitted with lining tube as prescribed in para. 11, except that lining tube is not required for boxes used for shipment of electric blasting caps packed in accordance with § 73.66(g)(1). When outer flaps butt, inner flaps must also butt, except that they may overlap not to exceed ½ inch, or outer flaps may overlap a minimum of 2 inches to and including full overlap, and inner flaps may be of same length as outer flaps.

(4) Three-piece box without recessed ends. Outer flap may be full lap style with a 3-inch or longer tuck. With the full lap style, the inner end flaps must have a minimum length of 4 inches with or without hand holes.

9. Forming. (a) Parts must be cut true to size and so creased and slotted as to fit closely into position without cracking, surface breaks, separation of parts outside of crease, or undue binding.

10. Joints. (a) Lapped 1½″ and stitched at 2½″ intervals and within 1″ of each end of joint; except for full depth telescope style boxes, body joints must be double-stitched (two parallel rows of stitches).

(b) For glued lap joint, the sides of box forming joint must lap not less than 1¼″ and be firmly glued throughout entire area of contact with a glue or adhesive which cannot be dissolved in water after the film application has dried.

(c) For lining tubes only, one butt joint taped (see paragraph 6) tape not less than 3″ wide is authorized.

11. Authorized gross weight and parts required. (a) Box shall be corrugated fibreboard at least 275 pound test. Tubes, when required, shall be of solid fibreboard at least 200-pound test, or of corrugated fibreboard of at least 275-pound test, with adjoining edges stitched, taped, or glued.

(b) Authorized gross weight: 65 pounds; boxes may have gross weight of 103 pounds when authorized by § 73.66(g)(1).

12. Closing for shipment. (a) By any method capable of withstanding tests prescribed by para. 16 without failure.

13. Marking. (a) On each container. Symbol in rectangle as follows:

CTC-12H**

(1) Stars to be replaced by authorized gross weight (for example CTC-12H65). This mark shall be understood to certify that the container complies with all specification requirements.

(2) Name and address of plant making the container; symbol (letters) authorized if recorded with the Bureau of Explosives through the Commission. This mark to be located just above or below the mark specified in paragraph (a) of this section.

(3) Size of markings: Specification markings prescribed in paragraph 13(a)(1) must be at least ½ in. high; other markings must be legible.

14. Special tests. (a) By whom and when. By or for each plant making the boxes; at beginning of manufacture and at six-month intervals thereafter; on largest size, by weight. Smaller sizes need not be tested if they have the same or equivalent construction. Report of results, with all pertinent data, to be maintained on file for one year; copy to be filed with the Commission and the Bureau of Explosives.

15. Material. (a) Box material must comply with requirements of paragraphs 3, 4, 7 and 11, and the following:

(b) Box material must have test strength and moisture content not over 30 per cent as follows:

(1) Box material must test at least 200 pounds per square inch immediately after exposure for 8 days to 90 per cent relative humidity of not less than 70° nor more than 75°F.

(2) Box material must test at least 100 pounds per square inch immediately after it has been in contact with water for 3 hours under 3″ head at not less than 70° nor more than 75°F.

NOTE: The test shall be conducted on a sample no greater than 6 inches in diameter when exposed to water. The sample shall be rigidly fastened to a water column device so constructed as to provide at least a 3-inch head of water on the outer surface of the fibreboard sample. The water column device must be suspended in such manner that free circulation of air on the inner surface of fibreboard sample which is not exposed to water is permitted. After contact with water for 3 hours under conditions specified, the water column device shall be emptied, the sample blotted, and immediately subjected to Mullen or Cady test. (A 6-inch diameter pipe having a welded flange to which the sample is secured by a bolted ring flange is acceptable).

16. Completed container. (a) Samples must pass the following immediately after exposure for 2 weeks to 90 per cent relative humidity at not less than 70° nor more than 75°F; loaded containers shall contain dummy contents of shape and weight of the expected contents, and shall be closed in the same manner as for shipment:

(1) Three loaded samples to be tested. Each must withstand 200 drops in standard 7-foot revolving test drum with pointed hazard in place, without spilling any contents.

(2) Three loaded samples to be tested. Each must withstand end to end pressure of at least 500 pounds without deflection of over 1½″.

(3) Three empty samples to be tested. Each must withstand top to bottom pressure of at least 500 pounds without deflection of over ½″.

(b) As an alternate to the drum test specified in paragraph (a), 3 loaded samples must pass the drop test specified below:

(1) Box shall be dropped from height of 2 feet.

(2) Identification of face, edge, and corners. Facing one end (with the manufacturer's joint on the observer's right), the top of the box is designated as 1, the right side as 2, the bottom as 3, and the left side as 4. The near end is designated as 5 and the far end as 6. The edges are identified by the number of the two faces which make that edge, as for example, 1-2 identifies the edge where the top and right side meet and 2-5 the edge having the manufacturer's joint. The corners are identified by the number of the three faces which meet to form that corner, as for example, 1-2-5 identifies the corner where the top, the right side, and the near end meet.

(c) Drop sequence as follows:

(1) A corner drop on 1-2-5.

(2) An edge drop on the shortest edge radiating from that corner (usually 2-5).

(3) An edge drop on the next shortest edge radiating from that corner (usually 1-5).

(4) An edge drop on the longest edge radiating from that corner (usually 1-2).

(5) A flatwise drop on one of the smallest faces (usually end 5 or 6).

(6) A flatwise drop on the opposite smallest face.

(7) A flatwise drop on one of the medium faces (usually side 2 or 4).

(8) A flatwise drop on the opposite medium face.

(9) A flatwise drop on one of the largest faces (usually top 1 or bottom 3).

(10) A flatwise drop on the opposite large face.

This completes one cycle of ten drops. Commence the next cycle, with a drop on the corner diagonally opposite through the box to the corner on which the first drop was made, on corner 3-4-6. Commence the third cycle of ten drops with corner 1-4-5. Each loaded container must withstand 3 cycles without spilling or sifting of contents.

Specification 12P

FIBREBOARD BOXES

Nonreusable containers for one inside plastic container greater than 1-gallon capacity.

1. Material requirements. (a) Boxes shall be of corrugated fibreboard, except as otherwise authorized in this specification, having both outer facings water resistant; corrugating medium shall be at least 0.009 inch thick and weigh not less than 26 pounds per 1,000 square feet; all parts shall be securely glued together throughout all contact areas.

(b) Solid fibreboard is authorized when of strength equal to corrugated fibreboard and in conformance with paragraph (c) of this section.

(c) Fibreboard required and tests as follows:

(1) Fibreboard is hereby classified by strength[1] of completed board as in first column of the following table; weights specified in the table are the minimums authorized.

Classified strength of completed board[1]	Solid fibreboard-minimum combined weight of component plies exclusive of adhesives (pounds per 1,000 sq.ft.)	Single-wall-minimum combined weight of facings (pounds per 1,000 sq. ft.)	Double-wall-minimum combined weight of facings including centre facings (pounds per 1,000 sq. ft.)
175	149	75	
200	190	84	92
275	237	138	110
325	237	138	110
350	283	180	126
375	283	180	180
400	283	180	180
450	283	180	180
500	330	.....	222

[1] Mullen or Cady Test (minimum).

(2) Tests of acceptable completed board must have prescribed strength, Mullen or Cady test, after exposure for at least 3 hours to normal atmospheric conditions (50 to 70 per cent relative humidity) under test, as follows:

(i) Clamp board firmly in machine and turn wheel at constant speed of approximately 2 revolutions per second.

(ii) Six bursts required, 3 from each side; all results but one must show prescribed strength.

(iii) Board failing may be retested by making 24 bursts, 12 from each side; when all results but 4 show prescribed strength the board is acceptable.

(iv) For corrugated fibreboard, double-pop tests may be disregarded.

2. Construction requirements. (a) Corrugated or solid fibreboard boxes of any type capable of withstanding tests prescribed by paragraph 5 authorized when constructed in accordance with requirements of this section.

(b) Corrugated or solid fibreboard boxes in accordance with the following table are authorized.

Gross weight not over (pounds)	Strength of fibreboard (minimum) Mullen or Cady test		
	Solid board	Single-wall corrugated	Double-wall corrugated
20	200	200	200
60	350	350	275
80	500	450	350

(c) All parts must be cut true to size and so creased and alotted as to fit closely into position without cracking, surface breaks, separation of parts outside of crease, or undue binding. Box must provide snug fit for inside plastic container.

(d) Joints (manufacturer's). The joint is defined as that part of the box where the ends of the sheet are joined together by taping, stitching or gluing.

(1) For glued or stitched lap joint, the sides of box forming joint must lap not less than 1¼ inches. Glued joints must be firmly glued throughout entire area of contact with a glue or adhesive which cannot be dissolved in water after film application has dried.

(2) Butt-joints, taped, are authorized providing resulting joints are capable of withstanding tests prescribed by paragraph 5.

3. Design limitations. (a) Design limitations are as follows:

(1) Permitted when perforated or die-cut areas remain intact following tests prescribed for box by paragraph 5.

(i) Outer closing flaps may have perforated areas of no greater size than is necessary to provide access to closure of plastic container; inner flaps may have die-cut areas of similar type.

(ii) Die-cut holes in outer and inner closing flaps when closure for plastic container is attached to a metal plate inserted between the inner and outer flaps or when closure area is protected by means of a plug-in or screw cap or similar device. The diameter of these holes shall be less than the diameter of the metal plate.

(iii) Inside facing of fibreboard closure flaps may be cut or perforated for opening. A tear strip may be incorporated in the body wall of fibreboard boxes provided it is above the shoulder area of the plastic container and this may be accompanied by a nominal thumb-notch in the manufacturer's joint or in a side panel of the box.

(iv) Handholes, by perforation or other means, in any part of the box providing the face having the handhole is backed up by a fibreboard sheet of equal strength of box in full height and width of that face or that handholes are above the neck area of the plastic container. No more than one handhole in any face nor more than two per box.

(v) Other perforated or die cut areas of a size and location as authorized in writing by the Bureau or the Commission.

(2) Not permitted:

(i) Stitched manufacturer's joint or stitched closures when any such stitch (staple) is in direct contact with the inside plastic container.

4. Closure. (a) Closure of any type is authorized provided representative boxes are capable of withstanding tests prescribed by paragraph 5.

5. Tests. (a) Representative samples of the completed composite container assembled, filled and closed as for use must be capable of withstanding tests prescribed in the specification for the inside plastic container without rupture of the fibreboard boxes that produces a condition of the box that could result in potential damage to the inside container.

6. Marking. (a) On each container. Symbol in rectangle as follows:

CTC-12P**

(1) Stars to be replaced by authorized gross weight for which box was constructed (for example, CTC-12P80). The letters NRC, located just above or below the CTC mark, to indicate a non-reusable container. These marks shall be understood to certify that the outer container complies with all the construction requirements of the specification.

(2) Name and address of plant making the container; symbol (letters) authorized if recorded with the Bureau of Explosives through the Commission. This mark to be

located just above or below the mark specified in (a) of this section.

(3) Size of markings. Specification markings as prescribed in paragraph (a) (1) of this section must be at least ½ inch high; other markings must be legible.

Specification 12R

PAPER-FACED EXPANDED POLYSTYRENE BOARD BOXES

Nonreusable containers.

1. Material requirements. (a) The board shall consist of completely fused closed cell expanded polystyrene with tightly adhered natural kraft paper facings for which detailed requirements are as follows:

(1) Basis weight of each facing, minimum, 42 pounds per 1,000 square feet. (Basis weight of combined facings, minimum, 84 pounds per 1,000 square feet.)

(2) Basis weight of board, minimum, 123 pounds per 1,000 square feet.

(3) Thickness of board, minimum, 0.21 inch.

(4) Moisture absorption, maximum, 25 grams weight gain per square foot with sample completely immersed in water. For one hour sample to be preconditioned to a constant weight at least 73°F. and 50 per cent relative humidity prior to immersion.

(5) Adhesion of facings; no delamination after 24 hours with sample completely immersed in water. Sample shall be not less than one square foot.

2. Forming. (a) Parts must be cut true to size and so creased and slotted as to fit closely in position without cracking, surface breaks, separation of parts outside of crease, or undue binding.

3. Joints. (a) Definition. The seam where the two edges of the box blank are joined by the box manufacturer.

(b) The joints shall be made by precrushing the lap area of the board to a minimum combined thickness of 0.28 inch, and then securing by either stitching or gluing as follows:

(1) By lapping 1½ inches from centre of score line and stitching at 2½ inch intervals and within 1 inch of each end joint; body joint over 18 inches long must be double stitched (2 parallel stitches) at each end of joint.

(2) By lapping 1½ inches from centre of score line and firm gluing throughout entire area of contact with an adhesive which cannot be dissolved in water after the adhesive applied had dried.

4. Inside cushioning. (a) Sufficient inside cushioning shall be required for protection of inside containers so that completed packages as offered for shipment shall be capable of withstanding test prescribed by para. 6.

(b) The cushioning shall be either paper-faced expanded polystyrene board meeting the requirements of para. 1 or equally efficient preformed completely fused closed cell expanded polystyrene.

5. Gross weight authorized. (a) Seventy-five pounds maximum.

6. Tests for completed packages. (a) A minimum of 4 boxes with inside containers filled with water, and box closed as for shipment shall be capable of withstanding either of the following tests without leakage from or breakage of any inside container or rupture of the outside containers:

(1) Drop test onto solid concrete; each box should be subjected to not more than one of the series of tests:

Box No. 1—Flat drop on bottom from height of 4 feet.

Box No. 2—Flat drop on side from height of 4 feet.

Box No. 3—Flat drop on end from height of 4 feet.

Box No. 4—Flat drop on top from height of 2 feet.

(2) Swing test on boxed glass swing test apparatus as prescribed by spec. 1A; each box shall be swung from 75 inches distance once on each of the six faces.

(b) Tests prescribed by paragraph (a) of this subsection must be conducted prior to initial use of the package and shall be repeated on the change of any components of the package.

7. Closing for shipment. (a) By any method capable of withstanding tests prescribed by para. 6.

8. Markings. (a) On each container. Symbol in rectangle as follows:

CTC-12R**

(1) Stars to be replaced by authorized gross weight (for example, CTC-12R75). The letters NRC, located just above or below the CTC mark, to indicate a non-reusable container. Those marks shall be understood to certify that the outer container complies with all construction requirements of the specification.

(2) Name or symbol (letters) of manufacturer and plant making the box or other party assuming responsibility for compliance with this specification; these must be registered with the Bureau of Explosives through the Commission. These markings shall be located on the same face as the other marks specified in paragraph (a) of this subsection.

(3) Size of markings. Specification markings prescribed in paragraph (a) (1) of this subsection must be at least ½ inch high; other markings must be legible.

Specification 13A

METAL DRUMS

1. Compliance. (a) Required in all details.

2. Type. (a) Straight sided; authorized only for material cast solid and with filling end head applied after material is loaded and closed in the manner prescribed in sec. 6. No other openings permitted.

3. Composition. (a) To be low carbon, open-hearth or electric steel.

4. Heads and body. (a) Heads. To be not less than 28 gauge United States standard.

(b) Body. To be not less than 28 gauge United States standard.

5. Seams. (a) Must be welded.

6. Heads. (a) To be attached by means of double lapped-seam.

7. Marking. (a) Marking on each container by embossing on head with raised marks as follows:

(1) CTC-13A. This mark shall be understood to certify that the container complies with all specification requirements.

(2) Size of markings (minimum): 5/16 inch high.

8. Type tests. (a) Drum filled and closed as for shipment must be capable of withstanding without rupture, 4 successive drops of 4 feet on the head on to solid concrete.

(b) Drum must be capable of withstanding hydrostatic pressure test of 30 pounds per square inch, sustained for 5 minutes.

(c) Tests to be made of each type and size by each company manufacturing this type of container and to be repeated every six months while in production. If production is discontinued and is resumed, this requirement will also apply if prescribed tests have not been made within the previous six-months period. Samples last tested to be retained until further tests are made or for one year, whichever period is shorter.

Specification 14

WOODEN BOXES, NAILED

1. Compliance. (a) Required in all details.

2. Lumber. (a) White pine or wood of at least equal strength, well seasoned, commercially dry, and free from decay, loose knots, knots that would interfere with nailing, and other defects that would materially lessen the strength. Grain of wood in cleats must not cross cleat within ½ its length.

3. Nails. (a) Cement coated, except as otherwise authorized, or screws of equal efficiency.

4. Ends, sides, tops, and bottoms. (a) Ends, sides, tops, and bottoms, as follows:

(1) Parts of 1-piece.

(2) Parts Linderman-joint glued.

(3) Parts tongued, grooved, and glued.

(4) Parts butt-joint glued, provided the joined surfaces are planed before gluing so as to assure full contact. After immersion in water for 24 hours at 70°F., the part must not fail at the joint when it is broken.

(b) Tongued, grooved and glued joints in uncleated ends must also be fastened with corrugated fasteners not over 8″ apart, within 3″ of each end of joint and having penetration 4/5 thickness of end.

5. Cleated ends. (a) Double cleated, 2 vertical and 2 horizontal. Nails staggered at 2″ intervals and clinched; cement coating not required.

6. Sides, tops, and bottoms. (a) Of size to extend out over cleats, if any.

7. Lock and dovetail corners. (a) Glued.

8. Parts and dimensions. (a) Parts and dimensions as follows:

Authorized gross weight (maximum) (pounds)	Type of box	Thickness of lumber (minimum)				Nails[1] (minimum size)	
		Ends[1]	Sides	Tops and bottoms[2]	Cleats	Into ends or cleats	Into sides
		Inches	Inch	Inch	Inches	Inch	Inch
35	Lock[1] Corner	7/16	7/16	5/16		1 3/4	1 3/4
65	Lock[1] Corner	1/2	1/2	3/8		1 3/4	1 3/4
75	Plain Nailed	7/8	1/2	1/3		2 1/4	1 3/4
75	Double Cleat	5/8	5/8	3/8	1/2×1 1/2	1 3/4	
140	Plain Nail[4]	1 1/2	5/8	5/8		2 1/2	2 1/4
140	Lock[1] Corner	5/8	5/8	5/8		2 1/4	2 1/4
140	Double Cleat	3/4	5/8	5/8	1 1/4×1 7/8	2 1/4	2 1/4

[1] Or dovetail

[2] Tops and bottoms may be made of paper covered veneer board of good quality Douglas fir, or lumber of equal quality, having minimum thickness of 1/2″ and free of breaks, gaps, holes, or knots. Paper covering shall be at least Kraft untreated linerboard having a basis weight of 42 pounds per 1000 square feet and shall be secured to veneer core by adhesive in such manner as to form a satisfactorily laminated board. Board ends must be provided with such reinforcement as may be necessary to provide strength for nailing.

[3] As provided by sec. 73.65 (a) (1) Note 1, boxes, having inside metal containers which are tightly and securely closed, may be equipped with hand holes in each end which must be not more than one inch by four inches and centred laterally not nearer than 1 5/8 inches from top edge of end of box.

[4] Coated wire staples are authorized in lieu of nails when used for fastening tops to boxes. Staples must be of such size and spaced and driven as to provide closure efficiency equivalent to that in para. 11 and 12.

9. Joints in sides and ends. (a) Staggered: except for ends cleated as prescribed.

10. Tops and bottoms. (a) Must fit evenly on frame of box.

11. Cleated boxes. (a) Sides, top, and bottom must be secured to ends by nails driven into cleats, not into end boards.

12. Nails in each nailing edge (minimum number). (a) At least equal to length of edge in inches divided by 2; when number of nails is at least equal to length of edge divided by 1¾, 1½ inch nails are authorized where 1¾ inch nails are prescribed.

Exception: Eight inch spacing authorized for nailing tops and bottoms to sides.

NOTE 1: Until further order of the Commission, the following exception is authorized for nailing tops to boxes. When 1¾ and 2 inch nails are required by sec. 8, 1½ inch nails are authorized if number of nails used is at least equal to length of end edge divided by 1¾ and length of side edge divided by 6.

13. Marking. (a) Marking on each box with letters and figures at least ½″ high in rectangle as follows:

CTC-14

(1) This mark shall be understood to certify that box complies with all specification requirements.

Specification 15A

WOODEN BOXES, NAILED

1. Compliance. (a) Required in all details.

2. Closed[2] box. (a) Parts and pieces to be in close contact.

3. Ends. (a) One-piece, or equivalent (see para. 5), or cleated as prescribed; joints tongued, grooved, and glued. Style 1 or style 6 boxes may have milled depressions in each end of box for hand-holds, of not more than ⅜ inch in depth and not exceeding one-third of the width of the box, only when ends are of lumber at least ¾ inch in thickness.

(b) As provided by sec. 73.65(a)(1) Note 1, wooden boxes, having inside metal containers which are tightly and securely closed, may be equipped with hand holes in each end which must be not more than one inch by four inches and centred laterally not nearer than 1⅝ inches from top edge of end of box.

4. Sides, top, and bottom. (a) Joints tongued, grooved, and glued, or one-piece equivalent, except that boxes for shipment of high explosives may have tops and bottoms made of paper-covered veneer board or good quality Douglas fir, or lumber of equal quality, having minimum thickness of ⅛ inch and free from decay, objectionable knots that interfere with nailing, splits, gaps, and other defects that materially lessen the strength. Paper covering shall be at least kraft untreated linerboard having a basis weight of 42 pounds per 1000 square feet and shall be secured to veneer core by adhesive in such manner as to form a satisfactorily laminated board. Board ends must be provided with such reinforcement as may be necessary to provide strength for nailing, and when used lumber thickness specified by para. 12 do not apply.

5. One-piece equivalents. (a) Parts are considered equivalent to one-piece as follows:

(1) Parts Linderman-joint glued.

(2) Parts at least ½″ thick, tongued and grooved and glued, with 2 or more corrugated fasteners on each joint.

(3) Parts, butt-joint glued, provided the joined surfaces are planed before gluing, so as to assure full contact. After immersion in water for 24 hours at 70°F. the part must not fail at the joint when it is broken.

(b) Corrugated fasteners (as prescribed for one-piece equivalents): 1″ wide; penetration 4/5 thickness of part; within 3″ of end of joint and not over 8″ apart; for 3 or more, drive alternately into opposite sides of part.

6. Gluing efficiency. (a) Shall be determined for boxes for gross weight of 150 pounds or less. When filled with sand and sawdust to marked gross weight, the boxes must be able to withstand 8 drops of 12″, one on each corner, on to solid concrete without exposure of contents.

7. Lumber. (a) To be well seasoned, commercially dry, and free from decay, loose knots, knots that would interfere with nailing, and other defects that would materially lessen the strength. Grain of wood in cleats must not cross cleat within ½ its length.

8. Nails. (a) Cement coated, unless otherwise authorized herein, of size specified for "sinkers" and "coolers" as generally known to the trade.

9. Grouping of principal woods. (a) Grouping as follows:

Group 1

White pine	Chestnut	White fir
Norway pine	Sugar pine	Cedar
Aspen (popple)	Cypress	Redwood
Spruce	Basswood	Butternut
Western (yellow) pine	Willow	Cucumber
Cottonwood	Noble fir	Alpine fir
Balsam fir	Magnolia	Lodgepole pine
Poplar	Buckeye	Jack pine
Red alder	Green ash	Red pine
Manitoba maple	Pine ponderosa	

Group 2

Southern yellow pine	North Carolina pine	Larch (tamarack)
Hemlock	Douglas fir	

Group 3

White elm	Pumpkin ash	Tupelo
Red gum	Black gum	Maple—soft or silver
Sycamore	Black ash	

Group 4

Hard maple	Hackberry	Hickory
Beech	Birch	White ash
Oak	Rock elm	

10. Width of pieces. (a) At least 2½″.

11. Width of cleats. (a) Twice the prescribed thickness plus ¾″.

12. Thickness of lumber. (a) Nailed boxes not cleated (Style 1). Authorized gross weight not over 100 pounds, see Note 1. Sides as in Table 1; top and bottom as in Table 1A; ends as in Table 5.

(b) Glued-lock-corner boxes (Style 6). Authorized gross weight not over 150 pounds. Sides as in Table 3; top and bottom as in Table 1A; ends as in Table 3A. Or, sides as in Table 2; top and bottom as in Table 1A; end as in Table 4.

(c) Single-cleated boxes (Style 4 or 5). Authorized gross weight not over 200 pounds, see Note 2. Sides as in Table 1; top and bottom as in Table 1A; ends and cleats as in Table 3A.

(d) Double-cleated boxes (Style 2, 2½, or 3). Authorized gross weight not over 500 pounds, see Note 3. Sides as in Table 1; top and bottom as in Table 1A; end and cleats as in Table 2A. Or, sides as in Table 1; top and bottom as in Table 1A; cleats as in Table 3B; ends not thinner than thickest side or top.

NOTE 1: When group II woods are used the gross weight may be increased to 110 pounds.

[2] Openings for filling device of inside container authorized if device is properly protected

NOTE 2: When group II woods are used the gross weight may be increased to 220 pounds.

NOTE 3: When group II woods are used the gross weight may be increased to 550 pounds.

(e) Tables are as follows (dimensions of materials finished or resawed):

TABLE 1

Depth of box (inches)	Not over 8"	Not over 9"	Not over 10"	Not over 12"	Not over 14"	Over 14"
Authorized gross weight (pounds)	Minimum thickness of part					
	Inches	Inches	Inch	Inch	Inch	Inch
15	5/16	5/16	5/16	5/16	5/16	5/16
25	5/16	5/16	5/16	5/16	5/16	5/16
35	5/16	5/16	5/16	5/16	5/16	5/16
45	11/32	11/32	11/32	11/32	11/32	11/32
55	3/8	11/32	11/32	11/32	11/32	11/32
65	3/8	3/8	11/32	11/32	11/32	11/32
75	7/16	3/8	3/8	11/32	11/32	11/32
85	7/16	7/16	3/8	3/8	11/32	11/32
100	1/2	7/16	7/16	3/8	3/8	11/32
125	9/16	1/2	1/2	7/16	3/8	3/8
150	5/8	9/16	9/16	1/2	7/16	3/8
175	5/8	5/8	9/16	1/2	1/2	7/16
200	11/16	5/8	5/8	9/16	1/2	7/16
250	25/32	3/4	11/16	5/8	9/16	1/2
300	13/16	13/16	3/4	11/16	5/8	9/16
350	15/16	7/8	13/16	3/4	11/16	5/8
400	1	15/16	7/8	13/16	3/4	11/16
500	1 1/8	1 1/16	1	15/16	7/8	3/4

TABLE 2

Depth of box (inches)	Not over 8"	Not over 9"	Not over 10"	Not over 12"	Not over 14"	Over 14"
Authorized gross weight (pounds)	Minimum thickness of part					
	Inches	Inches	Inches	Inches	Inch	Inch
15	11/32	11/32	11/32	11/32	11/32	11/32
25	11/32	11/32	11/32	11/32	11/32	11/32
35	3/8	11/32	11/32	11/32	11/32	11/32
45	7/16	3/8	3/8	11/32	11/32	11/32
55	1/2	7/16	3/8	3/8	11/32	11/32
65	1/2	1/2	7/16	3/8	3/8	11/32
75	9/16	1/2	1/2	7/16	3/8	3/8
85	9/16	9/16	1/2	7/16	7/16	3/8
100	5/8	9/16	9/16	1/2	7/16	7/16
125	11/16	5/8	5/8	9/16	1/2	7/16
150	3/4	11/16	11/16	5/8	9/16	1/2
175	13/16	3/4	11/16	11/16	5/8	9/16
200	7/8	13/16	3/4	3/4	11/16	5/8
250	1	15/16	7/8	13/16	3/4	5/8
300	1 1/16	1	15/16	7/8	25/32	11/16
350	1 1/8	1 1/16	1	15/16	7/8	3/4
400	1 3/16	1 1/8	1 1/16	1	15/16	13/16
500	.....	.....	1 1/8	1 1/16	1	7/8

TABLE 1A

Width of box (inches)	Not over 8"	Not over 9"	Not over 10"	Not over 12"	Not over 14"	Over 14"
Authorized gross weight (pounds)	Minimum thickness of part					
	Inches	Inches	Inch	Inch	Inch	Inch
15	5/16	5/16	5/16	5/16	5/16	5/16
25	5/16	5/16	5/16	5/16	5/16	5/16
35	5/16	5/16	5/16	5/16	5/16	5/16
45	11/32	11/32	11/32	11/32	11/32	11/32
55	3/8	11/32	11/32	11/32	11/32	11/32
65	3/8	3/8	11/32	11/32	11/32	11/32
75	7/16	3/8	3/8	11/32	11/32	11/32
85	7/16	7/16	3/8	3/8	11/32	11/32
100	1/2	7/16	7/16	3/8	3/8	11/32
125	9/16	1/2	1/2	7/16	3/8	3/8
150	5/8	9/16	9/16	1/2	7/16	3/8
175	5/8	5/8	9/16	1/2	1/2	7/16
200	11/16	5/8	5/8	9/16	1/2	7/16
250	25/32	3/4	11/16	5/8	9/16	1/2
300	13/16	13/16	3/4	11/16	5/8	9/16
350	15/16	7/8	13/16	3/4	11/16	5/8
400	1	15/16	7/8	13/16	3/4	11/16
500	1 1/8	1 1/16	1	15/16	7/8	3/4

TABLE 2A

Smallest dimension of end	Not over 8"	Not over 9"	Not over 10"	Not over 12"	Not over 14"	Over 14"
Authorized gross weight (pounds)	Minimum thickness of part					
	Inches	Inches	Inches	Inches	Inch	Inch
15	11/32	11/32	11/32	11/32	11/32	11/32
25	7/16	7/16	7/16	7/16	7/16	7/16
35	7/16	7/16	7/16	7/16	7/16	7/16
45	7/16	7/16	7/16	7/16	7/16	7/16
55	1/2	7/16	7/16	7/16	7/16	7/16
65	1/2	1/2	7/16	7/16	7/16	7/16
75	9/16	1/2	1/2	7/16	7/16	7/16
85	9/16	9/16	1/2	7/16	7/16	7/16
100	5/8	9/16	9/16	1/2	7/16	7/16
125	11/16	5/8	5/8	9/16	1/2	7/16
150	3/4	11/16	11/16	5/8	9/16	1/2
175	13/16	3/4	11/16	11/16	5/8	9/16
200	7/8	13/16	3/4	3/4	11/16	5/8
250	1	15/16	7/8	13/16	3/4	5/8
300	1 1/16	1	15/16	7/8	25/32	11/16
350	1 1/8	1 1/16	1	15/16	7/8	3/4
400	1 3/16	1 1/8	1 1/16	1	15/16	13/16
500	.....	.....	1 1/8	1 1/16	1	7/8

TABLE 3

Depth of box (inches)	Not over 8″	Not over 9″	Not over 10″	Not over 12″	Not over 14″	Over 14″
Authorized gross weight (pounds)	Minimum thickness of part					
	Inches	Inches	Inches	Inches	Inches	Inches
[illegible]	5/16	5/16	5/16	5/16	5/16	5/16
[illegible]	3/8	11/32	11/32	11/32	11/32	11/32
[illegible]	7/16	7/16	3/8	11/32	11/32	11/32
[illegible]	1/2	1/2	7/16	7/16	3/8	11/32
[illegible]	9/16	1/2	1/2	7/16	7/16	3/8
[illegible]	9/16	9/16	9/16	1/2	7/16	7/16
[illegible]	5/8	5/8	9/16	1/2	1/2	7/16
[illegible]	11/16	11/16	5/8	9/16	1/2	1/2
[illegible]	3/4	11/16	11/16	5/8	9/16	1/2
[illegible]	13/16	3/4	3/4	11/16	5/8	9/16
[illegible]	15/16	7/8	13/16	3/4	11/16	5/8
[illegible]	1	15/16	7/8	13/16	3/4	11/16
[illegible]	1 1/16	1	15/16	7/8	25/32	11/16
[illegible]	1 1/8	1 1/16	1	15/16	7/8	25/32
[illegible]	1 5/16	1 3/16	1 1/8	1 1/16	15/16	7/8
[illegible]	.....	1 5/16	1 1/4	1 1/8	1	15/16
[illegible]	.....	.....	.....	1 1/4	1 1/8	1
[illegible]	.....	.....	.....	.....	1 1/4	1 1/8

TABLE 3A

Smallest dimension of end	Not over 8″	Not over 9″	Not over 10″	Not over 12″	Not over 14″	Over 14″
Authorized gross weight (pounds)	Minimum thickness of part					
	Inches	Inches	Inches	Inches	Inches	Inches
[illegible]	11/32	11/32	11/32	11/32	11/32	11/32
[illegible]	7/16	7/16	7/16	7/16	7/16	7/16
[illegible]	7/16	7/16	7/16	7/16	7/16	7/16
[illegible]	1/2	1/2	7/16	7/16	7/16	7/16
[illegible]	9/16	1/2	1/2	7/16	7/16	7/16
[illegible]	9/16	9/16	9/16	1/2	7/16	7/16
[illegible]	5/8	5/8	9/16	1/2	1/2	7/16
[illegible]	11/16	11/16	5/8	9/16	1/2	1/2
[illegible]	3/4	11/16	11/16	5/8	9/16	1/2
[illegible]	13/16	3/4	3/4	11/16	5/8	9/16
[illegible]	15/16	7/8	13/16	3/4	11/16	5/8
[illegible]	1	15/16	7/8	13/16	3/4	11/16
[illegible]	1 1/16	1	15/16	7/8	25/32	11/16
[illegible]	1 1/8	1 1/16	1	15/16	7/8	25/32
[illegible]	1 5/16	1 3/16	1 1/8	1 1/16	15/16	7/8
[illegible]	.....	1 5/16	1 1/4	1 1/8	1	15/16
[illegible]	.....	.....	.....	1 1/4	1 1/8	1
[illegible]	.....	.....	.....	.....	1 1/4	1 1/8

TABLE 3B

Smallest dimension of end	Not over 8″	Not over 9″	Not over 10″	Not over 12″	Not over 14″	Over 14″
Authorized gross weight (pounds)	Minimum thickness of part					
	Inches	Inches	Inches	Inches	Inches	Inches
15	7/16	7/16	7/16	7/16	7/16	7/16
25	7/16	7/16	7/16	7/16	7/16	7/16
35	7/16	7/16	7/16	7/16	7/16	7/16
45	1/2	1/2	7/16	7/16	7/16	7/16
55	9/16	1/2	1/2	7/16	7/16	7/16
65	9/16	9/16	9/16	1/2	7/16	7/16
75	5/8	5/8	9/16	1/2	1/2	7/16
85	11/16	11/16	5/8	9/16	1/2	1/2
100	3/4	11/16	11/16	5/8	9/16	1/2
125	13/16	3/4	3/4	11/16	5/8	9/16
150	15/16	7/8	13/16	3/4	11/16	5/8
175	1	15/16	7/8	13/16	3/4	11/16
200	1 1/16	1	15/16	7/8	25/32	11/16
250	1 1/8	1 1/16	1	15/16	7/8	25/32
300	1 5/16	1 3/16	1 1/8	1 1/16	15/16	7/8
350	.....	1 5/16	1 1/4	1 1/8	1	15/16
400	.....	.....	.....	1 1/4	1 1/8	1
500	.....	.....	.....	.....	1 1/4	1 1/8

TABLE 4

Smallest dimension of end	Not over 8″	Not over 9″	Not over 10″	Not over 12″	Not over 14″	Over 14″
Authorized gross weight (pounds)	Minimum thickness of part					
	Inch	Inch	Inch	Inch	Inch	Inch
15	7/16	7/16	7/16	7/16	7/16	7/16
25	7/16	7/16	7/16	7/16	7/16	7/16
35	1/2	1/2	7/16	7/16	7/16	7/16
45	9/16	9/16	1/2	1/2	7/16	7/16
55	5/8	9/16	9/16	1/2	1/2	7/16
65	11/16	5/8	5/8	9/16	1/2	1/2
75	3/4	11/16	5/8	5/8	9/16	1/2
85	25/32	3/4	11/16	5/8	5/8	9/16
100	7/8	13/16	3/4	11/16	5/8	9/16
125	13/16	7/8	13/16	3/4	11/16	5/8
150	1	15/16	15/16	7/8	13/16	11/16

TABLE 5

Smallest dimension of end	Not over 8″	Not over 9″	Not over 10″	Not over 12″	Not over 14″	Over 14″
Authorized gross weight (pounds)	Minimum thickness of part					
	Inch	Inch	Inch	Inch	Inch	Inch
15	1/2	1/2	1/2	1/2	1/2	1/2
25	1/2	1/2	1/2	1/2	1/2	1/2
35	5/8	9/16	1/2	1/2	1/2	1/2
45	11/16	5/8	9/16	9/16	1/2	1/2
55	3/4	11/16	5/8	5/8	9/16	1/2
65	13/16	3/4	11/16	5/8	5/8	9/16
75	7/8	13/16	3/4	11/16	5/8	9/16
85	15/16	7/8	13/16	3/4	11/16	5/8
100	1	15/16	7/8	13/16	3/4	11/16

13. Reduced thicknesses. (a) Reduction in thicknesses is authorized as in paragraphs (a) to (d) of this section except that reduced thicknesses must be not less than:

(1) Sides, top, and bottom: Minimum 5/16″ for boxes up to 35 pounds authorized gross weight and ⅜″ above that weight.

(2) Ends or cleats: Minimum 7/16″.

(b) Sides of one-piece or equivalent: 12½ per cent.

(c) Any part or cleat of Group 3 or 4 wood: 20 per cent.

(d) Sides, top, and bottom when to be strapped as per para. 19(b): 20 per cent for 1 strap; 35 per cent for 2 straps.

CONVERSION TABLE

Specified thickness (inches)	Reduced thickness corresponding to per cent reduction		
	12 1/2	20	35
9/32	1/4	1/4	1/4
5/16	9/32	1/4	1/4
11/32	5/16	9/32	1/4
3/8	5/16	5/16	1/4
7/16	3/8	11/32	9/32
1/2	7/16	3/8	5/16
9/16	1/2	7/16	3/8
5/8	9/16	1/2	7/16
11/16	5/8	9/16	7/16
3/4	5/8	5/8	1/2
25/32	11/16	5/8	1/2
13/16	11/16	5/8	1/2
7/8	3/4	11/16	9/16
15/16	13/16	3/4	5/8
1	7/8	13/16	5/8
1 1/16	15/16	7/8	11/16
1 1/8	1	7/8	3/4
1 3/16	1 1/16	15/16	25/32
1 1/4	1 1/8	1	13/16
1 5/16	1 1/8	1 1/16	7/8

14. Assembly. (a) By nailing; screws, hinges and hasp, or other device of equal efficiency are authorized; nails should be driven flush.

15. Nails and nailing. (a) Cement coated nails of size and with spacing detailed in para. 16 and 17.

(b) At cleated edges drive at least 40 per cent of nails into cleats.

(c) Nails fastening cleats to be staggered and clinch ⅛″; uncoated nails authorized.

(d) Nailing tops and bottoms to sides permitted but not required.

16. Nails; kind and dimensions. (a) Cement[1] coated of gauge and length as for "sinkers" and "coolers" as generally known to the trade; size[2] in "inches" as follows:

Species of wood holding points of nails	Thickness of material holding points of nails (inches)										
	⅜ less	7/16	½	9/16	⅝	11/16	¾	25/32	13/16	⅞	15/16 or more
Group 1	1 1/2	1 3/4	1 3/4	2	2 1/4	2 1/4	2 1/2	2 1/2	2 1/2	2 3/4	3
Group 2	1 1/2	1 1/2	1 3/4	1 3/4	2	2	2 1/4	2 1/4	2 1/4	2 1/2	2 3/4
Group 3	1 1/4	1 1/2	1 1/2	1 3/4	1 3/4	2	2	2 1/4	2 1/4	2 1/4	2 1/2
Group 4	1 1/4	1 1/4	1 1/2	1 1/2	1 1/2	1 3/4	1 3/4	2	2	2 1/4	2 1/2

17. Nail spacing[3] (a) Nail spacing as follows:

Nails (size)	Maximum spacing when driven into end and cleats	
	Side grain	End grains
	Inches	Inches
1¼ inch	1¼	1
1½ inch	1½	1¼
1¾ inch	1¾	1½
2 inch	2	1¾
2¼ inch	2¼	2
2½ inch	2½	2¼
2¾ inch	2¾	2½
3 inch	3	2½

18. Marking. (a) Marking on each box with letters and figures at least ½″ high in rectangle as follows:

CTC-15A***

(1) The stars must be replaced by authorized gross weight (for example, BTC-15A100, etc.). This mark shall be understood to certify that box complies with all specification requirements.

(b) The words "ONE STRAP", or "TWO STRAPS", etc., when straps are required (see para. 13(d)); this to be placed above or below the rectangle.

(c) Marks may also be applied as follows:

CTC-15A

NO STRAP XXX LBS.
ONE STRAP XXX LBS.
TWO STRAPS XXX LBS.

(1) the "X's" must be replaced by authorized gross weights as authorized for the strapping conditions.

19. Closing for shipment. (a) Box to be securely closed. Nails, if used, to be as prescribed in para. 16 and 17.

(b) Metal straps, as specified by marks on box, must encircle sides, top, and bottom as follows:

(1) One nailless strap: At centre of box.

(2) Two or more nailless straps: Outer two about 1/6 of box length from ends and other equally spaced between.

(3) Nailed straps: At ends of sides, top, and bottom; use same size nails as for closing and space not over twice as far apart.

[1] Uncoated nails authorized when increased 25 per cent in number.

[2] Nails ¼ inch smaller authorized when spaced as for ½ inch smaller. Nails ½ inch smaller authorized, but not less than 1¼ inch when thickness of material nailed through does not exceed ½ of thickness of material holding points of nails.

[3] To determine number of nails, divide length of nailing edge by spacing; fractions greater than ½ are considered as whole numbers.

(4) Size of flat straps must be as follows:

Authorized gross weight (pounds)	Cross-section size when number of straps is—		
	1	2	3
	Inch	Inch	Inch
50	½ × 0.020	⅜ × 0.015	
100	⅝ × 0.020	½ × 0.018	
200	¾ × 0.023	⅝ × 0.020	½ × 0.018
300		⅝ × 0.023	½ × 0.020
400		¾ × 0.020	½ × 0.023
500		¾ × 0.023	⅝ × 0.023

(5) Wires, Washburn and Moen gauge, authorized as follows:

Authorized gross weight (pounds)	Gauge of wires when number of straps is—		
	1	2	3
50	12	14	
100	11	12	
200	9	11	12
300		10	11
400		10	11
500		9	10

Specification 15B

WOODEN BOXES, NAILED

1. Compliance. (a) Required in all details.

2. Closed[4] box. (a) Parts and pieces to be in close contact.

3. Ends. (a) One-piece or equivalent (see para. 5); or cleated as prescribed with joints tongued and grooved.

4. Sides, top, and bottom. (a) Joints tongued and grooved, or one-piece equivalent.

5. One-piece equivalents. (a) Parts are considered equivalent to one-piece as follows:

(1) Parts Linderman-joint glued.

(2) Parts at least ½″ thick, tongued and grooved and glued, with 2 or more corrugated fasteners on each joint.

(3) Parts at least ½″ thick, tongued and grooved and fastened with 3 or more corrugated fasteners on each joint.

(4) Parts butt-joint glued, provided the joined surfaces are planed before gluing, so as to assure full contact. After immersion in water for 24 hours at 70°F. the part must not fail at the joint when it is broken.

(b) Corrugated fasteners (as prescribed for one-piece equivalents): 1″ wide; penetration 4/5 thickness of part; within 3″ of end of joint and not over 8″ apart; for 3 or more, drive alternately into opposite sides of part.

6. Gluing efficiency. (a) Shall be determined for boxes for gross weight of 150 pounds or less. When filled with sand and sawdust to marked gross weight, the boxes must be able to withstand 8 drops of 12″, one on each corner, on to solid concrete without exposure of contents.

7. Lumber. (a) To be well seasoned, commercially dry, and free from decay, loose knots, knots that would interfere with nailing and other defects that would materially lessen the strength. Grain of wood in cleats must not cross cleat within ½ its length.

8. Nails. (a) Cement coated, unless otherwise authorized herein, of size specified for "sinkers" and "coolers" as generally known to the trade.

9. Grouping of principal woods. (a) Grouping as follows:

Group 1

White pine	Chestnut	White fir
Norway pine	Sugar pine	Cedar
Aspen (popple)	Cypress	Redwood
Spruce	Basswood	Butternut
Western (yellow) pine	Willow	Cucumber
Cottonwood	Noble fir	Alpine fir
Balsam fir	Magnolia	Lodgepole pine
Poplar	Buckeye	Jack pine
Red alder	Green ash	Red pine
Manitoba maple	Pine ponderosa	

Group 2

Southern yellow pine	North Carolina pine	Larch (tamarack)
Hemlock	Douglas fir	

Group 3

White elm	Pumpkin ash	Tupelo
Red gum	Black gum	Maple—soft or silver
Sycamore	Black ash	

Group 4

Hard maple	Hackberry	Hickory
Beech	Birch	White ash
Oak	Rock elm	

10. Width of pieces. (a) At least 2½″.

11. Width of cleats. (a) Twice the prescribed thickness plus ¾″.

12. Thickness of lumber. (a) Nailed boxes not cleated (Style 1). Authorized gross weight not over 100 pounds, see Note 1. Sides as in Table 1; top and bottom as in Table 1A; ends as in Table 5.

(b) Glued-lock-corner boxes (Style 6): Authorized gross weight not over 150 pounds. Sides as in Table 3; top and bottom as in Table 1A; ends as in Table 3A. Or, sides as in Table 2; top and bottom as in Table 1A; ends as in Table 4

(c) Single-cleated boxes (Style 4 or 5): Authorized gross weight not over 200 pounds, see Note 2. Sides as in Table 1; top and bottom as in Table 1A; ends and cleats as in Table 3A.

(d) Double-cleated boxes (Style 2, 2½, or 3): Authorized gross weight not over 500 pounds, see Note 3. Sides as in Table 1; top and bottom as in Table 1A; end and cleats as in Table 2A. Or, sides as in Table 1; top and bottom as in Table 1A; cleats as in Table 3B; ends not thinner than thickest side or top.

NOTE 1: When group II woods are used the gross weight may be increased to 110 pounds.

NOTE 2: When group II woods are used the gross weight may be increased to 220 pounds.

NOTE 3: When group II woods are used the gross weight may be increased to 550 pounds.

[4] Openings for filling device of inside container authorized if device is properly protected.

(e) Tables are as follows (dimensions of materials finished or resawed):

TABLE 1

Depth of box (inches)	Not over 8″	Not over 9″	Not over 10″	Not over 12″	Not over 14″	Over 14″
Authorized gross weight (pounds)	Minimum thickness of part					
	Inches	Inches	Inch	Inch	Inch	Inch
15	5/16	5/16	5/16	5/16	5/16	5/16
25	5/16	5/16	5/16	5/16	5/16	5/16
35	5/16	5/16	5/16	5/16	5/16	5/16
45	11/32	11/32	11/32	11/32	11/32	11/32
55	3/8	11/32	11/32	11/32	11/32	11/32
65	3/8	3/8	11/32	11/32	11/32	11/32
75	7/16	3/8	3/8	11/32	11/32	11/32
85	7/16	7/16	3/8	3/8	11/32	11/32
100	1/2	7/16	7/16	3/8	3/8	11/32
125	9/16	1/2	1/2	7/16	3/8	3/8
150	5/8	9/16	9/16	1/2	7/16	3/8
175	5/8	5/8	9/16	1/2	1/2	7/16
200	11/16	5/8	5/8	9/16	1/2	7/16
250	25/32	3/4	11/16	5/8	9/16	1/2
300	13/16	13/16	3/4	11/16	5/8	9/16
350	15/16	7/8	13/16	3/4	11/16	5/8
400	1	15/16	7/8	13/16	3/4	11/16
500	1 1/8	1 1/16	1	15/16	7/8	3/4

TABLE 2

Depth of box (inches)	Not over 8″	Not over 9″	Not over 10″	Not over 12″	Not over 14″	Over 14″
Authorized gross weight (pounds)	Minimum thickness of part					
	Inches	Inches	Inches	Inches	Inch	Inch
15	11/32	11/32	11/32	11/32	11/32	11/32
25	11/32	11/32	11/32	11/32	11/32	11/32
35	3/8	11/32	11/32	11/32	11/32	11/32
45	7/16	3/8	3/8	11/32	11/32	11/32
55	1/2	7/16	3/8	3/8	11/32	11/32
65	1/2	1/2	7/16	3/8	3/8	11/32
75	9/16	1/2	1/2	7/16	3/8	3/8
85	9/16	9/16	1/2	7/16	7/16	3/8
100	5/8	9/16	9/16	1/2	7/16	7/16
125	11/16	5/8	5/8	9/16	1/2	7/16
150	3/4	11/16	11/16	5/8	9/16	1/2
175	13/16	3/4	11/16	11/16	5/8	9/16
200	7/8	13/16	3/4	3/4	11/16	5/8
250	1	15/16	7/8	13/16	3/4	5/8
300	1 1/16	1	15/16	7/8	25/32	11/16
350	1 1/8	1 1/16	1	15/16	7/8	3/4
400	1 3/16	1 1/8	1 1/16	1	15/16	13/16
500	.....	.....	1 1/8	1 1/16	1	7/8

TABLE 1A

Width of box (inches)	Not over 8″	Not over 9″	Not over 10″	Not over 12″	Not over 14″	Over 14″
Authorized gross weight (pounds)	Minimum thickness of part					
	Inches	Inches	Inch	Inch	Inch	Inch
15	5/16	5/16	5/16	5/16	5/16	5/16
25	5/16	5/16	5/16	5/16	5/16	5/16
35	5/16	5/16	5/16	5/16	5/16	5/16
45	11/32	11/32	11/32	11/32	11/32	11/32
55	3/8	11/32	11/32	11/32	11/32	11/32
65	3/8	3/8	11/32	11/32	11/32	11/32
75	7/16	3/8	3/8	11/32	11/32	11/32
85	7/16	7/16	3/8	3/8	11/32	11/32
100	1/2	7/16	7/16	3/8	3/8	11/32
125	9/16	1/2	1/2	7/16	3/8	3/8
150	5/8	9/16	9/16	1/2	7/16	3/8
175	5/8	5/8	9/16	1/2	1/2	7/16
200	11/16	5/8	5/8	9/16	1/2	7/16
250	25/32	3/4	11/16	5/8	9/16	1/2
300	13/16	13/16	3/4	11/16	5/8	9/16
350	15/16	7/8	13/16	3/4	11/16	5/8
400	1	15/16	7/8	13/16	3/4	11/16
500	1 1/8	1 1/16	1	15/16	7/8	3/4

TABLE 2A

Smallest dimension of end	Not over 8″	Not over 9″	Not over 10″	Not over 12″	Not over 14″	Over 14″
Authorized gross weight (pounds)	Minimum thickness of part					
	Inches	Inches	Inches	Inches	Inch	Inch
15	11/32	11/32	11/32	11/32	11/32	11/32
25	7/16	7/16	7/16	7/16	7/16	7/16
35	7/16	7/16	7/16	7/16	7/16	7/16
45	7/16	7/16	7/16	7/16	7/16	7/16
55	1/2	7/16	7/16	7/16	7/16	7/16
65	1/2	1/2	7/16	7/16	7/16	7/16
75	9/16	1/2	1/2	7/16	7/16	7/16
85	9/16	9/16	1/2	7/16	7/16	7/16
100	5/8	9/16	9/16	1/2	7/16	7/16
125	11/16	5/8	5/8	9/16	1/2	7/16
150	3/4	11/16	11/16	5/8	9/16	1/2
175	13/16	3/4	11/16	11/16	5/8	9/16
200	7/8	13/16	3/4	3/4	11/16	5/8
250	1	15/16	7/8	13/16	3/4	5/8
300	1 1/16	1	15/16	7/8	25/32	11/16
350	1 1/8	1 1/16	1	15/16	7/8	3/4
400	1 3/16	1 1/8	1 1/16	1	15/16	13/16
500	.....	.....	1 1/8	1 1/16	1	7/8

TABLE 3

Depth of box (inches)	Not over 8″	Not over 9″	Not over 10″	Not over 12″	Not over 14″	Over 14″
Authorized gross weight (pounds)	Minimum thickness of part					
	Inches	Inches	Inches	Inches	Inches	Inches
15	5/16	5/16	5/16	5/16	5/16	5/16
25	3/8	11/32	11/32	11/32	11/32	11/32
35	7/16	7/16	3/8	11/32	11/32	11/32
[illegible]	1/2	1/2	7/16	7/16	3/8	11/32
[illegible]	9/16	1/2	1/2	7/16	7/16	3/8
[illegible]	9/16	9/16	9/16	1/2	7/16	7/16
[illegible]	5/8	5/8	9/16	1/2	1/2	7/16
[illegible]	11/16	11/16	5/8	9/16	1/2	1/2
[illegible]	3/4	11/16	11/16	5/8	9/16	1/2
[illegible]	13/16	3/4	3/4	11/16	5/8	9/16
[illegible]	15/16	7/8	13/16	3/4	11/16	5/8
[illegible]	1	15/16	7/8	13/16	3/4	11/16
[illegible]	1 1/16	1	15/16	7/8	25/32	11/16
[illegible]	1 1/8	1 1/16	1	15/16	7/8	25/32
[illegible]	1 5/16	1 3/16	1 1/8	1 1/16	15/16	7/8
[illegible]	.....	1 5/16	1 1/4	1 1/8	1	15/16
[illegible]	.....	.....	.....	1 1/4	1 1/8	1
[illegible]	.....	.....	.....	.....	1 1/4	1 1/8

TABLE 3A

Smallest dimension of end	Not over 8″	Not over 9″	Not over 10″	Not over 12″	Not over 14″	Over 14″
Authorized gross weight (pounds)	Minimum thickness of part					
	Inches	Inches	Inches	Inches	Inches	Inches
[illegible]	11/32	11/32	11/32	11/32	11/32	11/32
[illegible]	7/16	7/16	7/16	7/16	7/16	7/16
[illegible]	7/16	7/16	7/16	7/16	7/16	7/16
[illegible]	1/2	1/2	7/16	7/16	7/16	7/16
[illegible]	9/16	1/2	1/2	7/16	7/16	7/16
[illegible]	9/16	9/16	9/16	1/2	7/16	7/16
[illegible]	5/8	5/8	9/16	1/2	1/2	7/16
[illegible]	11/16	11/16	5/8	9/16	1/2	1/2
[illegible]	3/4	11/16	11/16	5/8	9/16	1/2
[illegible]	13/16	3/4	3/4	11/16	5/8	9/16
[illegible]	15/16	7/8	13/16	3/4	11/16	5/8
[illegible]	1	15/16	7/8	13/16	3/4	11/16
[illegible]	1 1/16	1	15/16	7/8	25/32	11/16
[illegible]	1 1/8	1 1/16	1	15/16	7/8	25/32
[illegible]	1 5/16	1 3/16	1 1/8	1 1/16	15/16	7/8
[illegible]	.....	1 5/16	1 1/4	1 1/8	1	15/16
[illegible]	.....	.....	.....	1 1/4	1 1/8	1
[illegible]	.....	.....	.....	.....	1 1/4	1 1/8

TABLE 3B

Smallest dimension of end	Not over 8″	Not over 9″	Not over 10″	Not over 12″	Not over 14″	Over 14″
Authorized gross weight (pounds)	Minimum thickness of part					
	Inches	Inches	Inches	Inches	Inches	Inches
15	7/16	7/16	7/16	7/16	7/16	7/16
25	7/16	7/16	7/16	7/16	7/16	7/16
35	7/16	7/16	7/16	7/16	7/16	7/16
45	1/2	1/2	7/16	7/16	7/16	7/16
55	9/16	1/2	1/2	7/16	7/16	7/16
65	9/16	9/16	9/16	1/2	7/16	7/16
75	5/8	5/8	9/16	1/2	1/2	7/16
85	11/16	11/16	5/8	9/16	1/2	1/2
100	3/4	11/16	11/16	5/8	9/16	1/2
125	13/16	3/4	3/4	11/16	5/8	9/16
150	15/16	7/8	13/16	3/4	11/16	5/8
175	1	15/16	7/8	13/16	3/4	11/16
200	1 1/16	1	15/16	7/8	25/32	11/16
250	1 1/8	1 1/16	1	15/16	7/8	25/32
300	1 5/16	1 3/16	1 1/8	1 1/16	15/16	7/8
350	.....	1 5/16	1 1/4	1 1/8	1	15/16
400	.....	.....	.....	1 1/4	1 1/8	1
500	.....	.....	.....	.....	1 1/4	1 1/8

TABLE 4

Smallest dimension of end	Not over 8″	Not over 9″	Not over 10″	Not over 12″	Not over 14″	Over 14″
Authorized gross weight (pounds)	Minimum thickness of part					
	Inch	Inch	Inch	Inch	Inch	Inch
15	7/16	7/16	7/16	7/16	7/16	7/16
25	7/16	7/16	7/16	7/16	7/16	7/16
35	1/2	1/2	7/16	7/16	7/16	7/16
45	9/16	9/16	1/2	1/2	7/16	7/16
55	5/8	9/16	9/16	1/2	1/2	7/16
65	11/16	5/8	5/8	9/16	1/2	1/2
75	3/4	11/16	5/8	5/8	9/16	1/2
85	25/32	3/4	11/16	5/8	5/8	9/16
100	7/8	13/16	3/4	11/16	5/8	9/16
125	15/16	7/8	13/16	3/4	11/16	5/8
150	1	15/16	15/16	7/8	13/16	11/16

TABLE 5

Smallest dimension of end	Not over 8″	Not over 9″	Not over 10″	Not over 12″	Not over 14″	Over 14″
Authorized gross weight (pounds)	Minimum thickness of part					
	Inch	Inch	Inch	Inch	Inch	Inch
15	1/2	1/2	1/2	1/2	1/2	1/2
25	1/2	1/2	1/2	1/2	1/2	1/2
35	5/8	9/16	1/2	1/2	1/2	1/2
45	11/16	5/8	9/16	9/16	1/2	1/2
55	3/4	11/16	5/8	5/8	9/16	1/2
65	13/16	3/4	11/16	5/8	5/8	9/16
75	7/8	13/16	3/4	11/16	5/8	9/16
85	15/16	7/8	13/16	3/4	11/16	5/8
100	1	15/16	7/8	13/16	3/4	11/16

13. Reduced thicknesses. (a) Reduction in thicknesses is authorized as in paragraphs (a) to (d) of this section except that reduced thicknesses must be not less than:

(1) Sides, top, and bottom: Minimum 5/16″ for boxes up to 35 pounds authorized gross weight and ⅜″ above that weight.

(2) Ends or cleats: Minimum 7/16″.

(b) Sides of one-piece or equivalent: 12½ per cent.

(c) Any part or cleat of Group 3 or 4 wood: 20 per cent.

(d) Sides, top, and bottom when to be strapped as per sec. 19(b): 20 per cent for 1 strap; 35 per cent for 2 straps.

CONVERSION TABLE

Specified thickness (inches)	Reduced thickness corresponding to per cent reduction		
	12 1 2	20	35
9 32	1 4	1 4	1 4
5 16	9 32	1 4	1 4
11 32	5 16	9 32	1 4
3 8	5 16	5 16	1 4
7 16	3 8	11 32	9 32
1 2	7 16	3 8	5 16
9 16	1 2	7 16	3 8
5 8	9 16	1 2	7 16
11 16	5 8	9 16	7 16
3 4	5 8	5 8	1 2
25 32	11 16	5 8	1 2
13 16	11 16	5 8	1 2
7 8	3 4	11 16	9 16
15 16	13 16	3 4	5 8
1	7 8	13 16	5 8
1 1 16	15 16	7 8	11 16
1 1 8	1	7 8	3 4
1 3 16	1 1 16	15 16	25 32
1 1 4	1 1 8	1	13 16
1 5 16	1 1 8	1 1 16	7 8

14. Assembly. (a) By nailing; screws, hinges and hasp, or other device of equal efficiency are authorized; nails should be driven flush.

15. Nails and nailing. (a) Cement coated nails of size and with spacing detailed in para. 16 and 17.

(b) At cleated edges drive at least 40 per cent of nails into cleats.

(c) Nails fastening cleats to be staggered and clinch ⅓″; uncoated nails authorized.

(d) Nailing tops and bottoms to sides permitted but not required.

16. Nails; kind and dimensions. (a) Cement[1] coated of gauge and length as for "sinkers" and "coolers" as generally known to the trade; size 2 in "inches" as follows:

Species of wood holding points of nails	Thickness of material holding points of nails (inches)										
	⅜ less	7 16	½	9 16	⅝	11 16	¾	25 32	13 16	⅞	15 16 or more
Group 1	1	1¼	1¼	2	2¼	2¼	2½	2½	2½	2¾	3
Group 2	1	1½	1¾	1¾	2	2	2¼	2¼	2¼	2½	2¾
Group 3	1¼	1½	1½	1¾	1¾	2	2	2¼	2¼	2½	2¾
Group 4	1¼	1½	1½	1½	1½	1¾	1¾	2	2	2¼	2¼

17. Nail spacing[3] (a) Nail spacing as follows:

Nails (size)	Maximum spacing when driven into end and cleats	
	Side grain	End grains
	Inches	Inches
1¼ inch	1¼	1
1½ inch	1½	1¼
1¾ inch	1¾	1½
2 inch	2	1¾
2¼ inch	2¼	2
2½ inch	2½	2¼
2¾ inch	2¾	2½
3 inch	3	2½

18. Marking. (a) Marking on each box with letters and figures at least ½″ high in rectangle as follows:

CTC-15B***

(1) The stars must be replaced by authorized gross weight (for example, BTC-15B125, etc.). This mark shall be understood to certify that box complies with all specification requirements.

(b) The words "ONE STRAP", or "TWO STRAPS", etc., when straps are required (see sec. 13(d)); this to be placed above or below the rectangle.

(c) Marks may also be applied as follows:

CTC-15B

NO STRAP XXX LBS.
ONE STRAP XXX LBS.
TWO STRAPS XXX LBS.

(1) The "X's" must be replaced by authorized gross weights as authorized for the strapping conditions.

19. Closing for shipment. (a) Box to be securely closed. Nails, if used, to be as prescribed in para. 16 and 17.

(b) Metal straps, as specified by marks on box, must encircle sides, top, and bottom as follows:

(1) One nailless strap: At centre of box.

(2) Two or more nailless straps: Outer two about 1/6 of box length from ends and other equally spaced between.

(3) Nailed straps: At ends of sides, top, and bottom; use same size nails as for closing and space not over twice as far apart.

[1] Uncoated nails authorized when increased 25 per cent in number.

[2] Nails ¼ inch smaller authorized when spaced as for ½ inch smaller. Nails ½ inch smaller authorized, but not less than 1¼ inch when thickness of material nailed through does not exceed ½ of thickness of material holding points of nails.

[3] To determine number of nails, divide length of nailing edge by spacing; fractions greater than ½ are considered as whole numbers.

(4) Size of flat straps must be as follows:

Authorized gross weight (pounds)	Cross-section size when number of straps is—		
	1	2	3
	Inch	Inch	Inch
50	½ × 0.020	⅜ × 0.015	
100	⅝ × 0.020	½ × 0.018	
200	¾ × 0.023	⅝ × 0.020	½ × 0.018
300		⅝ × 0.023	½ × 0.020
400		¾ × 0.020	½ × 0.023
500		¾ × 0.023	⅝ × 0.023

(5) Wires, Washburn and Moen gauge, authorized as follows:

Authorized gross weight (pounds)	Gauge of wires when number of straps is—		
	1	2	3
50	12	14	
100	11	12	
200	9	11	12
300		10	11
400		10	11
500		9	10

Specification 15C

WOODEN BOXES, NAILED

1. Compliance. (a) Required in all details.

2. Closed[4] box. (a) Parts and pieces to be in close contact.

3. Ends. (a) One-piece, or equivalent (see para. 4); or cleated as prescribed.

4. One-piece equivalents. (a) Parts are considered equivalent to one-piece as follows:

(1) Parts Linderman-joint glued.

(2) Parts at least ½″ thick, tongued and grooved and glued, with 2 or more corrugated fasteners on each joint.

(3) Parts at least ½″ thick fastened with 3 or more corrugated fasteners on each joint.

(4) Parts butt-joint glued, provided the joined surfaces are planed before gluing, so as to assure full contact. After immersion in water for 24 hours at 70°F. the part must not fail at the joint when it is broken.

(b) Corrugated fasteners (as prescribed for one-piece equivalents): 1″ wide; penetration 4/5 thickness of part; within 3″ of end of joint and not over 8″ apart; for 3 or more, drive alternately into opposite sides of part.

5. Gluing efficiency. (a) Shall be determined for boxes for gross weight of 150 pounds or less. When filled with sand and sawdust to marked gross weight, the boxes must be able to withstand 8 drops of 12″, one on each corner, on to solid concrete without exposure of contents.

[4] Openings for filling device of inside container authorized if device is properly protected

6. Lumber. (a) To be well seasoned, commercially dry, and free from decay, loose knots that would interfere with nailing, and other defects that would materially lessen the strength. Grain of wood in cleats must not cross cleat within ½ its length.

7. Nails. (a) Cement coated, unless otherwise authorized herein, of size specified for "sinkers" and "coolers" as generally known to the trade.

8. Grouping of principal woods. (a) Grouping as follows:

Group 1

White pine	Chestnut	White fir
Norway Pine	Sugar pine	Cedar
Aspen (popple)	Cypress	Redwood
Spruce	Basswood	Butternut
Western (yellow) pine	Willow	Cucumber
Cottonwood	Noble fir	Alpine fir
Balsam fir	Magnolia	Lodgepole pine
Poplar	Buckeye	Jack pine
Red alder	Green ash	Red pine
Manitoba maple	Pine ponderosa	

Group 2

Southern yellow pine	North Carolina pine	Larch (tamarack)
Hemlock	Douglas fir	

Group 3

White elm	Pumpkin ash	Tupelo
Red gum	Black gum	Maple soft or silver
Sycamore	Black ash	

Group 4

Hard maple	Hackberry	Hickory
Beech	Birch	White ash
Oak	Rock elm	

9. Width of pieces. (a) At least 2½″.

10. Width of cleats. (a) Twice the prescribed thickness plus ¾″.

11. Thickness of lumber. (a) Nailed boxes not cleated (Style 1): Authorized gross weight not over 100 pounds (see Note ...). Sides as in Table 1; top and bottom as in Table 1A; ends as in Table 5.

(b) Glued-lock-corner boxes (Style 6): Authorized gross weight not over 150 pounds. Sides as in Table 3; top and bottom as in Table 1A; ends as in Table 3A. Or, sides as in Table 2; top and bottom as in Table 1A; ends as in Table 4.

(c) Single-cleated boxes (Style 4 or 5): Authorized gross weight not over 200 pounds (see Note 2). Sides as in Table 1; top and bottom as in Table 1A ends and cleats as in Table 3A.

(d) Double-cleated boxes (Style 2, 2½, or 3): Authorized gross weight not over 500 pounds (see Note 3). Sides as in Table 1; top and bottom as in Table 1A; end and cleats as in Table 2A. Or, sides as in Table 1; top and bottom as in Table 1A; cleats as in Table 3B; ends not thinner than thickest side or top.

NOTE 1: When group II woods are used the gross weight may be increased to 110 pounds.

NOTE 2: When group II woods are used the gross weight may be increased to 220 pounds.

NOTE 3: When group II woods are used the gross weight may be increased to 550 pounds.

(e) Tables are as follows (dimensions of materials finished or resawed):

TABLE 1

Depth of box (inches)	Not over 8″	Not over 9″	Not over 10″	Not over 12″	Not over 14″	Over 14″
Authorized gross weight (pounds)	Minimum thickness of part					
	Inches	Inches	Inch	Inch	Inch	Inch
15	1/4	1/4	1/4	1/4	1/4	1/4
25	1/4	1/4	1/4	1/4	1/4	1/4
35	5/16	9/32	9/32	1/4	1/4	1/4
45	11/32	5/16	5/16	9/32	1/4	1/4
55	3/8	11/32	11/32	5/16	9/32	1/4
65	3/8	3/8	11/32	5/16	5/16	9/32
75	7/16	3/8	3/8	11/32	11/32	9/32
85	7/16	7/16	3/8	3/8	11/32	5/16
100	1/2	7/16	7/16	3/8	3/8	11/32
125	9/16	1/2	1/2	7/16	3/8	3/8
150	5/8	9/16	9/16	1/2	7/16	3/8
175	5/8	5/8	9/16	1/2	1/2	7/16
200	11/16	5/8	5/8	9/16	1/2	7/16
250	25/32	3/4	11/16	5/8	9/16	1/2
300	13/16	13/16	3/4	11/16	5/8	9/16
350	15/16	7/8	13/16	3/4	11/16	5/8
400	1	15/16	7/8	13/16	3/4	11/16
500	1 1/8	1 1/16	1	15/16	7/8	3/4

TABLE 1A

Width of box (inches)	Not over 8″	Not over 9″	Not over 10″	Not over 12″	Not over 14″	Over 14″
Authorized gross weight (pounds)	Minimum thickness of part					
	Inches	Inches	Inch	Inch	Inch	Inch
15	1/4	1/4	1/4	1/4	1/4	1/4
25	1/4	1/4	1/4	1/4	1/4	1/4
35	5/16	9/32	9/32	1/4	1/4	1/4
45	11/32	5/16	5/16	9/32	1/4	1/4
55	3/8	11/32	11/32	5/16	9/32	1/4
65	3/8	3/8	11/32	5/16	5/16	9/32
75	7/16	3/8	3/8	11/32	11/32	9/32
85	7/16	7/16	3/8	3/8	11/32	5/16
100	1/2	7/16	7/16	3/8	3/8	11/32
125	9/16	1/2	1/2	7/16	3/8	3/8
150	5/8	9/16	9/16	1/2	7/16	3/8
175	5/8	5/8	9/16	1/2	1/2	7/16
200	11/16	5/8	5/8	9/16	1/2	7/16
250	25/32	3/4	11/16	5/8	9/16	1/2
300	13/16	13/16	3/4	11/16	5/8	9/16
350	15/16	7/8	13/16	3/4	11/16	5/8
400	1	15/16	7/8	13/16	3/4	11/16
500	1 1/8	1 1/16	1	15/16	7/8	3/4

TABLE 2

Depth of box (inches)	Not over 8″	Not over 9″	Not over 10″	Not over 12″	Not over 14″	Over 14″
Authorized gross weight (pounds)	Minimum thickness of part					
	Inches	Inches	Inches	Inches	Inch	Inch
15	11/32	11/32	5/16	9/32	1/4	1/4
25	11/32	11/32	5/16	9/32	1/4	1/4
35	3/8	11/32	5/16	5/16	9/32	1/4
45	7/16	3/8	3/8	11/32	5/16	9/32
55	1/2	7/16	3/8	3/8	11/32	5/16
65	1/2	1/2	7/16	3/8	3/8	11/32
75	9/16	1/2	1/2	7/16	3/8	3/8
85	9/16	9/16	1/2	7/16	7/16	3/8
100	5/8	9/16	9/16	1/2	7/16	7/16
125	11/16	5/8	5/8	9/16	1/2	7/16
150	3/4	11/16	11/16	5/8	9/16	1/2
175	13/16	3/4	11/16	11/16	5/8	9/16
200	7/8	13/16	3/4	3/4	11/16	5/8
250	1	15/16	7/8	13/16	3/4	5/8
300	1 1/16	1	15/16	7/8	25/32	11/16
350	1 1/8	1 1/16	1	15/16	7/8	3/4
400	1 3/16	1 1/8	1 1/16	1	15/16	13/16
500	.....	.....	1 1/8	1 1/16	1	7/8

TABLE 2A

Smallest dimension of end	Not over 8″	Not over 9″	Not over 10″	Not over 12″	Not over 14″	Over 14″
Authorized gross weight (pounds)	Minimum thickness of part					
	Inches	Inches	Inches	Inches	Inch	Inch
15	11/32	11/32	11/32	11/32	11/32	11/32
25	7/16	7/16	7/16	7/16	7/16	7/16
35	7/16	7/16	7/16	7/16	7/16	7/16
45	7/16	7/16	7/16	7/16	7/16	7/16
55	1/2	7/16	7/16	7/16	7/16	7/16
65	1/2	1/2	7/16	7/16	7/16	7/16
75	9/16	1/2	1/2	7/16	7/16	7/16
85	9/16	9/16	1/2	7/16	7/16	7/16
100	5/8	9/16	9/16	1/2	7/16	7/16
125	11/16	5/8	5/8	9/16	1/2	7/16
150	3/4	11/16	11/16	5/8	9/16	1/2
175	13/16	3/4	11/16	11/16	5/8	9/16
200	7/8	13/16	3/4	3/4	11/16	5/8
250	1	15/16	7/8	13/16	3/4	5/8
300	1 1/16	1	15/16	7/8	25/32	11/16
350	1 1/8	1 1/16	1	15/16	7/8	3/4
400	1 3/16	1 1/8	1 1/16	1	15/16	13/16
500	.....	.....	1 1/8	1 1/16	1	7/8

TABLE 3

Depth of box (inches)	Not over 8″	Not over 9″	Not over 10″	Not over 12″	Not over 14″	Over 14″
Authorized gross weight (pounds)	Minimum thickness of part					
	Inches	Inches	Inches	Inches	Inches	Inches
15	9/32	9/32	1/4	1/4	1/4	1/4
25	3/8	11/32	11/32	5/16	9/32	1/4
35	7/16	7/16	3/8	11/32	11/32	9/32
45	1/2	1/2	7/16	7/16	3/8	11/32
55	9/16	1/2	1/2	7/16	7/16	3/8
65	9/16	9/16	9/16	1/2	7/16	7/16
75	5/8	5/8	9/16	1/2	1/2	7/16
85	11/16	11/16	5/8	9/16	1/2	1/2
100	3/4	11/16	11/16	5/8	9/16	1/2
125	13/16	3/4	3/4	11/16	5/8	9/16
150	15/16	7/8	13/16	3/4	11/16	5/8
175	1	15/16	7/8	13/16	3/4	11/16
200	1 1/16	1	15/16	7/8	25/32	11/16
250	1 1/8	1 1/16	1	15/16	7/8	25/32
300	1 5/16	1 3/16	1 1/8	1 1/16	15/16	7/8
350	.....	1 5/16	1 1/4	1 1/8	1	15/16
400	.....	.....	.....	1 1/4	1 1/8	1
500	.....	.....	.....	.....	1 1/4	1 1/8

TABLE 3A

Smallest dimension of end	Not over 8″	Not over 9″	Not over 10″	Not over 12″	Not over 14″	Over 14″
Authorized gross weight (pounds)	Minimum thickness of part					
	Inches	Inches	Inches	Inches	Inches	Inches
15	11 32	11 32	11 32	11 32	11 32	11 32
25	7/16	7/16	7/16	7/16	7/16	7/16
35	7/16	7/16	7/16	7/16	7/16	7/16
45	1/2	1/2	7/16	7/16	7/16	7/16
55	9/16	1/2	1/2	7/16	7/16	7/16
65	9/16	9/16	9/16	1/2	7/16	7/16
75	5/8	5/8	9/16	1/2	1/2	7/16
85	11/16	11/16	5/8	9/16	1/2	1/2
100	3/4	11/16	11/16	5/8	9/16	1/2
125	13/16	3/4	3/4	11/16	5/8	9/16
150	15/16	7/8	13/16	3/4	11/16	5/8
175	1	15 16	7 8	13/16	3/4	11/16
200	1 1/16	1	15 16	7/8	25/32	11/16
250	1 1 8	1 1/16	1	15/16	7/8	25/32
300	1 5 16	1 3 16	1 1 8	1 1/16	15/16	7/8
350	.....	1 5 16	1 1 4	1 1/8	1	15/16
400	.....	.....	.....	1 1 4	1 1/4	1
500	.....	.....	.....	.....	1 1/4	1 1/8

TABLE 3B

Smallest dimension of end	Not over 8″	Not over 9″	Not over 10″	Not over 12″	Not over 14″	Over 14″
Authorized gross weight (pounds)	Minimum thickness of part					
	Inches	Inches	Inches	Inches	Inches	Inches
15	7/16	7/16	7/16	7/16	7/16	7/16
25	7/16	7/16	7/16	7/16	7/16	7/16
35	7/16	7/16	7/16	7/16	7/16	7/16
45	1/2	1/2	7/16	7/16	7/16	7/16
55	9/16	1/2	1/2	7/16	7/16	7/16
65	9/16	9/16	9/16	1/2	7/16	7/16
75	5/8	5/8	9/16	1/2	1/2	7/16
85	11/16	11/16	5/8	9/16	1/2	1/2
100	3/4	11/16	11/16	5/8	9/16	1/2
125	13/16	3/4	3/4	11/16	5/8	9/16
150	15/16	7/8	13/16	3/4	11/16	5/8
175	1	15/16	7/8	13/16	3/4	11/16
200	1 1 16	1	15 16	7 8	25/32	11/16
250	1 1 8	1 1 16	1	15 16	7/8	25/32
300	1 5 16	1 3 16	1 1 8	1 1 16	15/16	7/8
350	.....	1 5 16	1 1 4	1 1 8	1	15, 16
400	.....	.....	.....	1 1 4	1 1/8	1
500	.....	.....	.....	.....	1 1/4	1 1/8

TABLE 4

Smallest dimension of end	Not over 8″	Not over 9″	Not over 10″	Not over 12″	Not over 14″	Over 14″
Authorized gross weight (pounds)	Minimum thickness of part					
	Inch	Inch	Inch	Inch	Inch	Inch
15	7 16	7/16	7/16	7/16	7/16	7/16
25	7 16	7/16	7/16	7/16	7/16	7/16
35	1 2	1/2	7/16	7/16	7/16	7/16
45	9 16	9/16	1/2	1/2	7/16	7/16
55	5 8	9/16	9/16	1/2	1/2	7/16
65	11 16	5/8	5/8	9/16	1/2	1/2
75	3 4	11/16	5/8	5/8	9/16	1/2
85	25 32	3/4	11/16	5/8	5/8	9/16
100	7 8	13/16	3/4	11/16	5/8	9/16
125	15 16	7/8	13/16	3/4	11/16	5/8
150	1	15/16	15/16	7/8	13/16	11/16

TABLE 5

Smallest dimension of end	Not over 8″	Not over 9″	Not over 10″	Not over 12″	Not over 14″	Over 14″
Authorized gross weight (pounds)	Minimum thickness of part					
	Inch	Inch	Inch	Inch	Inch	Inch
15	1 2	1/2	1/2	1/2	1/2	1/2
25	1 2	1/2	1/2	1/2	1/2	1/2
35	5 8	9/16	1/2	1/2	1/2	1/2
45	11 16	5/8	9/16	9/16	1/2	1/2
55	3 4	11/16	5/8	5/8	9/16	1/2
65	13 16	3/4	11/16	5/8	5/8	9/16
75	7 8	13/16	3/4	11/16	5/8	9/16
85	15 16	7/8	13/16	3/4	11/16	5/8
100	1	15/16	7/8	13/16	3/4	11/16

12. Reduced thicknesses. (a) Reduction in thickness is authorized as in paragraphs (a) to (d) of this section except that reduced thicknesses must be not less than:

(1) Sides, top, and bottom: Minimum ¼″ for boxes up to 150 pounds authorized gross weight and ⅜″ above that weight.

(2) Ends or cleats: Minimum 7/16″.

(b) Sides of one-piece or equivalent: 12½ per cent.

(c) Any part or cleat of Group 3 or 4 wood: 20 per cent.

(d) Sides, top, and bottom when to be strapped as per para. 18(b): 20 per cent for 1 strap; 35 per cent for 2 straps.

CONVERSION TABLE

Specified thickness (inches)	Reduced thickness corresponding to per cent reduction		
	12 1/2	20	35
9/32	1/4	1/4	1/4
5/16	9/32	1/4	1/4
11/32	5/16	9/32	1/4
3/8	5/16	5/16	1/4
7/16	3/8	11/32	9/32
1/2	7/16	3/8	5/16
9/16	1/2	7/16	3/8
5/8	9/16	1/2	7/16
11/16	5/8	9/16	7/16
3/4	5/8	5/8	1/2
25/32	11/16	5/8	1/2
13/16	11/16	5/8	1/2
7/8	3/4	11/16	9/16
15/16	13/16	3/4	5/8
1	7/8	13/16	5/8
1 1/16	15/16	7/8	11/16
1 1/8	1	7/8	3/4
1 3/16	1 1/16	15/16	25/32
1 1/4	1 1/8	1	13/16
1 5/16	1 1/8	1 1/16	7/8

13. Assembly. (a) By nailing; screws, hinges and hasp, or other device of equal efficiency are authorized; nails should be driven flush.

14. Nails and nailing. (a) Cement coated nails of size and with spacing detailed in para. 15 and 16.

(b) At cleated edges drive at least 40 per cent of nails into cleats.

(c) Nails fastening cleats to be staggered and clinch ⅛″; uncoated nails authorized.

(d) Nailing tops and bottoms to sides permitted but not required.

15. Nails; kind and dimensions. (a) Cement[1] coated of gauge and length as for "sinkers" and "coolers" as generally known to the trade; size[2] in "inches" as follows:

Species of wood holding points of nails	Thickness of material holdings points of nails (inches)										
	⅜ or less	7/16	½	9/16	⅝	11/16	¾	25/32	13/16	⅞	15/16 or more
Group 1	1 ¼	1¼	1¼	2	2¼	2¼	2½	2½	2½	2¾	3
Group 2	1½	1½	1¾	1¾	2	2	2¼	2¼	2¼	2½	2¾
Group 3	1¼	1½	1 ¾	1¾	1¾	2	2	2¼	2¼	2¼	2½
Group 4	1¼	1¼	1½	1½	1½	1¾	1¾	2	2	2½	2¾

16. Nail spacing[3] (a) Nail spacing as follows:

Nails (size)	Maximum spacing when driven into end and cleats	
	Side grain	End grains
	Inches	Inches
1¼ inch	1¼	1
1½ inch	1½	1¼
1¾ inch	1¾	1½
2 inch	2	1¾
2¼ inch	2¼	2
2½ inch	2½	2¼
2¾ inch	2¾	2½
3 inch	3	2½

17. Marking. (a) Marking on each box with letters and figures at least ½″ high in rectangle as follows:

CTC-15C***

(1) The stars must be replaced by authorized gross weight (for example, BTC-15C100, etc.). This mark shall be understood to certify that box complies with all specification requirements.

(b) The words "ONE STRAP", or "TWO STRAPS", etc., when straps are required (see sec. 12(d)); this to be placed above or below the rectangle.

(c) Marks may also be applied as follows:

CTC-15C

NO STRAP XXX LBS.
ONE STRAP XXX LBS.
TWO STRAPS XXX LBS.

(1) The "X's" must be replaced by authorized gross weights as authorized for the strapping conditions.

18. Closing for shipment. (a) Box to be securely closed. Nails, if used, to be as prescribed in para. 15 and 16.

(b) Metal straps, as specified by marks on box, must encircle sides, top, and bottom as follows:

(1) One nailless strap: At centre of box.

(2) Two or more nailless straps: Outer two about 1/6 of box length from ends and other equally spaced between.

(3) Nailed straps: At ends of sides, top, and bottom; use same size nails as for closing and space not over twice as far apart.

[1] Uncoated nails authorized when increased 25 per cent in number.

[2] Nails ¼ inch smaller authorized when spaced as for ½ inch smaller. Nails ½ inch smaller authorized, but not less than ¾ inch when thickness of material nailed through does not exceed ½ of thickness of material holding points of nails.

[3] To determine number of nails, divide length of nailing edge by spacing; fractions greater than ½ are considered as whole numbers.

(4) Size of flat straps must be as follows:

Authorized gross weight (pounds)	Cross-section size when number of straps is—		
	1	2	3
	Inch	Inch	Inch
50	½ × 0.020	⅜ × 0.015	
100	⅝ × 0.020	½ × 0.018	
200	¾ × 0.023	⅝ × 0.020	½ × 0.018
300		⅝ × 0.023	½ × 0.020
400		¾ × 0.020	½ × 0.023
500		¾ × 0.023	⅝ × 0.023

(5) Wires, Washburn and Moen gauge, authorized as follows:

Authorized gross weight (pounds)	Gauge of wires when number of straps is—		
	1	2	3
50	12	14	
100	11	12	
200	9	11	12
300		10	11
400		10	11
500		9	10

Specification 15D

WOODEN BOXES, NAILED

1. Compliance. (a) Required in all details.

2. Spaces between boards. (a) Space 4″ wide authorized except that bottom pieces must be in close contact with each other and with sides and ends.

3. Ends. (a) One-piece, or equivalent (see sec. 5); or cleated as prescribed.

4. Handles. (a) Containers may be provided with suitable handles at discretion of shipper. Handles must be of dimensions specified herein, consisting of horizontal strips or cleats extending across top of each side or each end; handles which do not project 3 inches beyond the vertical edges of the container must be mounted to leave at least 7/16 inch open space between handle and box, or be at least ¾ inch thick, or be of cross section at least equal to cleats required for single-cleated boxes of corresponding size and gross weight. Extension of cleats or side boards is acceptable for projecting handles.

Authorized gross weight, maximum (pounds):	Handles, minimum cross section (inches)
100	½ × 1¾
150	½ × 2¾
200	⅝ × 2½
300	⅝ × 3½
400	13/16 × 3½

5. One-piece equivalents. (a) Parts are considered equivalent to one-piece as follows:

(1) Parts Linderman-joint glued.

(2) Parts at least ½″ thick, tongued and grooved and glued, with 2 or more corrugated fasteners on each joint.

(3) Parts at least ½″ thick fastened with 3 or more corrugated fasteners on each joint.

(4) Parts butt-joint glued, provided the joined surfaces are planed before gluing, so as to assure full contact. After immersion in water for 24 hours at 70°F. the part must not fail at the joint when it is broken.

(b) Corrugated fasteners (as prescribed for one-piece equivalents). 1″ wide; penetration 4/5 thickness of part; within 3″ of end of joint and not over 8″ apart; for 3 or more, drive alternately into opposite sides of part.

6. Gluing efficiency. (a) Shall be determined for boxes for gross weight of 150 pounds or less. When filled with sand and sawdust to marked gross weight, the boxes must be able to withstand 8 drops of 12″, one on each corner, on to solid concrete without exposure of contents.

7. Lumber. (a) To be well seasoned, commercially dry, and free from decay, loose knots, knots that would interfere with nailing, and other defects that would materially lessen the strength. Grain of wood in cleats must not cross cleat within ½ its length.

8. Nails. (a) Cement coated, unless otherwise authorized herein, of size specified for "sinkers" and "coolers" as generally known to the trade.

9. Grouping of principal woods. (a) Grouping as follows:

Group 1

White Pine	Chestnut	White fir
Norway pine	Sugar pine	Cedar
Aspen (popple)	Cypress	Redwood
Spruce	Basswood	Butternut
Western (yellow) pine	Willow	Cucumber
Cottonwood	Noble fir	Alpine fir
Balsam fir	Magnoha	Lodgepole pine
Poplar	Buckeye	Jack pine
Red alder	Green ash	Red pine
Manitoba maple	Pine ponderosa	

Group 2

Souther yellow pine	North Carolina pine	Larch (tamarack)
Hemlock	Douglas fir	

Group 3

White elm	Pumpkin ash	Tupelo
Red gum	Black gum	Maple soft or sliver
Sycamore	Black ash	

Group 4

Hard maple	Hackberry	Hickory
Beech	Birch	White ash
Oak	Rock elm	

10. Width of pieces. (a) At least 2½″.

11. Width of cleats. (a) Twice the prescribed thickness plus ¾″.

12. Thickness of lumber. (a) Nailed boxes not cleated (Style 1): Authorized gross weight not over 100 pounds, see Note 1. Sides as in Table 1; top and bottom as in Table 1A; ends as in Table 5.

(b) Glued-lock-corner boxes (Style 6): Authorized gross weight not over 150 pounds. Sides as in Table 3; top and bottom as in Table 1A; ends as in Table 3A. Or, sides as in Table 2; top and bottom as in Table 1A; ends as in Table 4.

(c) Single-cleated boxes (Style 4 or 5): Authorized gross weight not over 200 pounds for boxes with vertical cleats nor over 400 pounds for boxes with horizontal cleats.

Sides as in Table 1; top and bottom as in Table 1A; ends and cleats as in Table 3A.

(d) Double-cleated boxes (Style 2, 2½, or 3): Authorized gross weight not over 500 pounds. Sides as in Table 1; top and bottom as in Table 1A; ends and cleats as in Table 2A. Or, sides as in Table 1; top and bottom as in Table 1A, cleats as in Table 3B; ends not thinner than thinnest side or top.

Exception: For containers consisting of an inner wooden crate of at least ⅞" thickness throughout, with or without top, and an outside double cleated box without the openings permitted by sec. 2, the thickness of all parts of the outside box may be reduced to not less than ¾".

(e) Tables are as follows (dimensions of materials finished or resawed):

TABLE 1

Depth of box (inches)	Not over 8"	Not over 9"	Not over 10"	Not over 12"	Not over 14"	Over 14"
Authorized gross weight (pounds)	Minimum thickness of part					
	Inches	Inches	Inch	Inch	Inch	Inch
15	5/16	5/16	5/16	5/16	5/16	5/16
25	5/16	5/16	5/16	5/16	5/16	5/16
35	5/16	5/16	5/16	5/16	5/16	5/16
45	11/32	11/32	11/32	11/32	11/32	11/32
55	3/8	11/32	11/32	11/32	11/32	11/32
65	3/8	3/8	11/32	11/32	11/32	11/32
75	7/16	3/8	3/8	11/32	11/32	11/32
85	7/16	7/16	3/8	3/8	11/32	11/32
100	1/2	7/16	7/16	3/8	3/8	11/32
125	9/16	1/2	1/2	7/16	3/8	3/8
150	5/8	9/16	9/16	1/2	7/16	3/8
175	5/8	5/8	9/16	1/2	1/2	7/16
200	11/16	5/8	5/8	9/16	1/2	7/16
250	25/32	3/4	11/16	5/8	9/16	1/2
300	13/16	13/16	3/4	11/16	5/8	9/16
350	15/16	7/8	13/16	3/4	11/16	5/8
400	1	15/16	7/8	13/16	3/4	11/16
500	1 1/8	1 1/16	1	15/16	7/8	3/4

TABLE 1A

Width of box (inches)	Not over 8"	Not over 9"	Not over 10"	Not over 12"	Not over 14"	Over 14"
Authorized gross weight (pounds)	Minimum thickness of part					
	Inches	Inches	Inch	Inch	Inch	Inch
15	5/16	5/16	5/16	5/16	5/16	5/16
25	5/16	5/16	5/16	5/16	5/16	5/16
35	5/16	5/16	5/16	5/16	5/16	5/16
45	11/32	11/32	11/32	11/32	11/32	11/32
55	3/8	11/32	11/32	11/32	11/32	11/32
65	3/8	3/8	11/32	11/32	11/32	11/32
75	7/16	3/8	3/8	11/32	11/32	11/32
85	7/16	7/16	3/8	3/8	11/32	11/32
100	1/2	7/16	7/16	3/8	3/8	11/32
125	9/16	1/2	1/2	7/16	3/8	3/8
150	5/8	9/16	9/16	1/2	7/16	3/8
175	5/8	5/8	9/16	1/2	1/2	7/16
200	11/16	5/8	5/8	9/16	1/2	7/16
250	25/32	3/4	11/16	5/8	9/16	1/2
300	13/16	13/16	3/4	11/16	5/8	9/16
350	15/16	7/8	13/16	3/4	11/16	5/8
400	1	15/16	7/8	13/16	3/4	11/16
500	1 1/8	1 1/16	1	15/16	7/8	3/4

TABLE 2

Depth of box (inches)	Not over 8"	Not over 9"	Not over 10"	Not over 12"	Not over 14"	Over 14"
Authorized gross weight (pounds)	Minimum thickness of part					
	Inches	Inches	Inches	Inches	Inch	Inch
15	11/32	11/32	11/32	11/32	11/32	11/32
25	11/32	11/32	11/32	11/32	11/32	11/32
35	3/8	11/32	11/32	11/32	11/32	11/32
45	7/16	3/8	3/8	11/32	11/32	11/32
55	1/2	7/16	3/8	3/8	11/32	11/32
65	1/2	1/2	7/16	3/8	3/8	11/32
75	9/16	1/2	1/2	7/16	3/8	3/8
85	9/16	9/16	1/2	7/16	7/16	3/8
100	5/8	9/16	9/16	1/2	7/16	7/16
125	11/16	5/8	5/8	9/16	1/2	7/16
150	3/4	11/16	11/16	5/8	9/16	1/2
175	13/16	3/4	11/16	11/16	5/8	9/16
200	7/8	13/16	3/4	3/4	11/16	5/8
250	1	15/16	7/8	13/16	3/4	5/8
300	1 1/16	1	15/16	7/8	25/32	11/16
350	1 1/8	1 1/16	1	15/16	7/8	3/4
400	1 3/16	1 1/8	1 1/16	1	15/16	13/16
500	.....	.....	1 1/8	1 1/16	1	7/8

TABLE 2A

Smallest dimension of end	Not over 8"	Not over 9"	Not over 10"	Not over 12"	Not over 14"	Over 14"
Authorized gross weight (pounds)	Minimum thickness of part					
	Inches	Inches	Inches	Inches	Inch	Inch
15	11/32	11/32	11/32	11/32	11/32	11/32
25	7/16	7/16	7/16	7/16	7/16	7/16
35	7/16	7/16	7/16	7/16	7/16	7/16
45	7/16	7/16	7/16	7/16	7/16	7/16
55	1/2	7/16	7/16	7/16	7/16	7/16
65	1/2	1/2	7/16	7/16	7/16	7/16
75	9/16	1/2	1/2	7/16	7/16	7/16
85	9/16	9/16	1/2	7/16	7/16	7/16
100	5/8	9/16	9/16	1/2	7/16	7/16
125	11/16	5/8	5/8	9/16	1/2	7/16
150	3/4	11/16	11/16	5/8	9/16	1/2
175	13/16	3/4	11/16	11/16	5/8	9/16
200	7/8	13/16	3/4	3/4	11/16	5/8
250	1	15/16	7/8	13/16	3/4	5/8
300	1 1/16	1	15/16	7/8	25/32	11/16
350	1 1/8	1 1/16	1	15/16	7/8	3/4
400	1 3/16	1 1/8	1 1/16	1	15/16	13/16
500	.....	.....	1 1/8	1 1/16	1	7/8

TABLE 3

Depth of box (inches)	Not over 8″	Not over 9″	Not over 10″	Not over 12″	Not over 14″	Over 14″
Authorized gross weight (pounds)	Minimum thickness of part					
	Inches	Inches	Inches	Inches	Inches	Inches
[illegible]	5 16	5/16	5/16	5/16	5/16	5/16
[illegible]	3 8	11/32	11/32	11/32	11/32	11/32
[illegible]	7 16	7/16	3/8	11/32	11/32	11/32
[illegible]	1 2	1/2	7/16	7/16	3/8	11/32
[illegible]	9 16	1/2	1/2	7/16	7/16	3/8
[illegible]	9 16	9/16	9/16	1/2	7/16	7/16
[illegible]	5 8	5/8	9/16	1/2	1/2	7/16
[illegible]	11 16	11/16	5/8	9/16	1/2	1/2
100	3 4	11/16	11/16	5/8	9/16	1/2
[illegible]	13 16	3/4	3/4	11/16	5/8	9/16
[illegible]	15 16	7/8	13/16	3/4	11/16	5/8
[illegible]	1	15/16	7/8	13/16	3/4	11/16
[illegible]	1 1 16	1	15 16	7 8	25 32	11/16
[illegible]	1 1 8	1 1 16	1	15 16	7 8	25/32
[illegible]	1 5 16	1 3 16	1 1 8	1 1 16	15 16	7/8
[illegible]	.....	1 5 16	1 1 4	1 1 8	1	15/16
[illegible]	.....	.....	.....	1 1 4	1 1 8	1
[illegible]	.....	.....	.....	.....	1 1 4	1 1/8

TABLE 3A

Smallest dimension of end	Not over 8″	Not over 9″	Not over 10″	Not over 12″	Not over 14″	Over 14″
Authorized gross weight (pounds)	Minimum thickness of part					
	Inches	Inches	Inches	Inches	Inches	Inches
[illegible]	11 32	11/32	11/32	11/32	11/32	11/32
[illegible]	7 16	7/16	7/16	7/16	7/16	7/16
[illegible]	7 16	7/16	7/16	7/16	7/16	7/16
[illegible]	1 2	1/2	7/16	7/16	7/16	7/16
[illegible]	9 16	1/2	1/2	7/16	7/16	7/16
[illegible]	9 16	9/16	9/16	1/2	7/16	7/16
[illegible]	5 8	5/8	9/16	1/2	1/2	7/16
[illegible]	11 16	11/16	5/8	9/16	1/2	1/2
[illegible]	3 4	11/16	11/16	5/8	9/16	1/2
[illegible]	13 16	3/4	3/4	11/16	5/8	9/16
[illegible]	15 16	7/8	13/16	3/4	11/16	5/8
[illegible]	1	15/16	7/8	13/16	3/4	11/16
[illegible]	1 1 16	1	15/16	7/8	25/32	11/16
[illegible]	1 1 8	1 1/16	1	15/16	7/8	25/32
[illegible]	1 5 16	1 3/16	1 1/8	1 1/16	15/16	7/8
[illegible]	.....	1 5/16	1 1/4	1 1/8	1	15/16
[illegible]	.....	.....	.....	1 1/4	1 1/8	1
[illegible]	.....	.....	.....	.....	1 1/4	1 1/8

TABLE 3B

Smallest dimension of end	Not over 8″	Not over 9″	Not over 10″	Not over 12″	Not over 14″	Over 14″
Authorized gross weight (pounds)	Minimum thickness of part					
	Inches	Inches	Inches	Inches	Inches	Inches
15	7/16	7/16	7/16	7/16	7/16	7/16
25	7/16	7/16	7/16	7/16	7/16	7/16
35	7/16	7/16	7/16	7/16	7/16	7/16
45	1/2	1/2	7/16	7/16	7/16	7/16
55	9/16	1/2	1/2	7/16	7/16	7/16
65	9/16	9/16	9/16	1/2	7/16	7/16
75	5/8	5/8	9/16	1/2	1/2	7/16
85	11/16	11/16	5/8	9/16	1/2	1/2
100	3/4	11/16	11/16	5/8	9/16	1/2
125	13/16	3/4	3/4	11/16	5/8	9/16
150	15/16	7/8	13/16	3/4	11/16	5/8
175	1	15/16	7/8	13/16	3/4	11/16
200	1 1/16	1	15/16	7/8	25/32	11/16
250	1 1/8	1 1/16	1	15/16	7/8	25/32
300	1 5/16	1 3/16	1 1/8	1 1/16	15/16	7/8
350	.....	1 5/16	1 1/4	1 1/8	1	15/16
400	.....	.....	.....	1 1/4	1 1/8	1
500	.....	.....	.....	.....	1 1/4	1 1/8

TABLE 4

Smallest dimension of end	Not over 8″	Not over 9″	Not over 10″	Not over 12″	Not over 14″	Over 14″
Authorized gross weight (pounds)	Minimum thickness of part					
	Inch	Inch	Inch	Inch	Inch	Inch
15	7 16	7/16	7/16	7/16	7/16	7/16
25	7 16	7/16	7/16	7/16	7/16	7/16
35	1 2	1/2	7/16	7/16	7/16	7/16
45	9 16	9/16	1/2	1/2	7/16	7/16
55	5 8	9/16	9/16	1/2	1/2	7/16
65	11 16	5/8	5/8	9/16	1/2	1/2
75	3 4	11/16	5/8	5/8	9/16	1/2
85	25 32	3/4	11/16	5/8	5/8	9/16
100	7 8	13/16	3/4	11/16	5/8	9/16
125	15 16	7/8	13/16	3/4	11/16	5/8
150	1	15/16	15/16	7/8	13/16	11/16

TABLE 5

Smallest dimension of end	Not over 8″	Not over 9″	Not over 10″	Not over 12″	Not over 14″	Over 14″
Authorized gross weight (pounds)	Minimum thickness of part					
	Inch	Inch	Inch	Inch	Inch	Inch
15	1 2	1/2	1/2	1/2	1/2	1/2
25	1 2	1/2	1/2	1/2	1/2	1/2
35	5 8	9/16	1/2	1/2	1/2	1/2
45	11 16	5/8	9/16	9/16	1/2	1/2
55	3 4	11/16	5/8	5/8	9/16	1/2
65	13 16	3/4	11/16	5/8	5/8	9/16
75	7 8	13/16	3/4	11/16	5/8	9/16
85	15 16	7/8	13/16	3/4	11/16	5/8
100	1	15/16	7/8	13/16	3/4	11/16

13. Reduced thicknesses. (a) Reduction in thicknesses is authorized as in paragraphs (a) to (d) of this section except that reduced thicknesses must be not less than:

(1) Sides, top, and bottom: Minimum 5/16″ for boxes up to 35 pounds authorized gross weight and ⅜″ above that weight.

(2) Ends or cleats: Minimum 7/16″.

(b) Sides of one-piece or equivalent: 12½ per cent. In battery boxes reinforced with separate pieces in the form of extension handles, not extension of side boards or cleats, having cross section at least equal to cleats required for single-cleated boxes of corresponding size and gross weight, 20 per cent in sides or ends so reinforced.

(c) Any part or cleat of Group 3 or 4 Wood: 20 per cent.

(d) Sides, top, and bottom when to be strapped as per sec. 18(b): 20 per cent for 1 strap; 35 per cent for 2 straps.

CONVERSION TABLE

Specified thickness (inches)	Reduced thickness corresponding to per cent reduction		
	12½	20	35
9/32	¼	¼	¼
5/16	9/32	¼	¼
11/32	5/16	9/32	¼
⅜	5/16	5/16	¼
7/16	⅜	11/32	9/32
½	7/16	⅜	5/16
9/16	½	7/16	⅜
⅝	9/16	½	7/16
11/16	⅝	9/16	7/16
¾	⅝	⅝	½
25/32	11/16	⅝	½
13/16	11/16	⅝	½
⅞	¾	11/16	9/16
15/16	13/16	¾	⅝
1	⅞	13/16	⅝
1 1/16	15/16	⅞	11/16
1⅛	1	⅞	¾
1 3/16	1 1/16	15/16	25/32
1 ¼	1 ⅛	1	13/16
1 5/16	1 ⅛	1 1/16	⅞

14. Nails and nailing. (a) Cement coated nails of size and with spacing detailed in para. 15 and 16.

(b) At cleated edges drive at least 40 per cent of nails into cleats.

(c) Nails fastening cleats to be staggered and clinch ⅛″; uncoated nails authorized.

(d) Nailing tops and bottoms to sides permitted but not required.

15. Nails; kind and dimensions. (a) Cement[1] coated of gauge and length as for "sinkers" and "coolers" as generally known to the trade; size[2] in "inch" as follows:

Species of wood holding points of nails	Thickness of material holding points of nails (inches)										
	⅜ or less	7/16	½	9/16	⅝	11/16	¾	25/32	13/16	⅞	15/16 or more
Group 1	1 ¼	1 ¾	1 ¾	2	2 ¼	2 ¼	2 ½	2 ½	2 ½	2 ¾	3
Group 2	1 ¼	1 ½	1 ¾	1 ¾	2	2	2 ¼	2 ¼	2 ¼	2 ½	2 ¾
Group 3	1 ¼	1 ½	1 ½	1 ¾	1 ¾	2	2	2 ¼	2 ¼	2 ¾	2 ½
Group 4	1 ¼	1 ¼	1 ½	1 ½	1 ½	1 ¾	1 ¾	2	2	2 ¼	2 ¼

16. Nail spacing.[3] (a) Nail spacing as follows:

Nails (size)	Maximum spacing when driven into end and cleeats	
	Side grain	End grains
	Inches	
1¼ inch	1¼	1
1½ inch	1½	1¼
1¾ inch	1¾	1½
2 inch	2	1¾
2¼ inch	2¼	2
2½ inch	2½	2¼
2¾ inch	2¾	2½
3 inch	3	2½

17. Marking. (a) Marking on each box with letters and figures at least ½″ high in rectangle as follows:

CTC-15D***

(1) The stars must be replaced by authorized gross weight (for example, BTC-15D125, etc.). This mark shall be understood to certify that box complies with all specification requirements.

(b) The words "ONE STRAP", or "TWO STRAPS", etc., when straps are required (see para. 13(d)); this to be placed above or below the rectangle.

(c) Marks may also be applied as follows:

CTC-15D

NO STRAP XXX LBS.
ONE STRAP XXX LBS.
TWO STRAPS XXX LBS.

(1) The "X's" must be replaced by authorized gross weights as authorized for the strapping conditions.

18. Closing for shipment. (a) Box to be securely closed. Nails, if used, to be as prescribed in paras. 15 and 16.

(b) Metal straps, as specified by marks on box, must encircle sides, top, and bottom as follows:

(1) One nailless strap: At centre of box.

(2) Two or more nailless straps: Outer two about 1/6 of box length from ends and other equally spaced between.

(3) Nailed straps: At ends of sides, top, and bottom; use same size nails as for closing and space not over twice as far apart.

[1] Uncoated nails authorized when increased 25 per cent in number.

[2] Nails ¼ inch smaller authorized when spaced as for ½ inch smaller. Nails ½ inch smaller authorized, but not less than ¾ inch when thickness of material nailed through does not exceed ½ of thickness of material holding points of nails.

[3] To determine number of nails, divide length of nailing edge by spacing; fractions greater than ½ are considered as whole numbers.

(4) Size of flat straps must be as follows:

Authorized gross weight (pounds)	Cross-section size when number of straps is—		
	1	2	3
	Inch	Inch	Inch
50	½ × 0.020	⅔ × 0.015	
100	⅝ × 0.020	½ × 0.018	
200	¾ × 0.023	⅝ × 0.020	½ × 0.018
300		⅝ × 0.023	½ ×0.020
400		¾ × 0.020	½ × 0.023
500		¾ × 0.023	5 × 0.023

(5) Wires, Washburn and Moen gauge, authorized as follows:

Authorized gross weight (pounds)	Gauge of wires when number of straps is—		
	1	2	3
50	12	14	
100	11	12	
200	9	11	12
300		10	11
400		10	11
500		9	10

19. Boxes for shipment of wet electric storage batteries. (a) Boxes over 500 pounds gross weight are authorized for shipments of wet electric storage batteries when the batteries are contained in a rigid cradle or box, or are securely fastened together so as to form a single unit, and not more than one such cradle, box, or unit is packed in the outside container. Skids required: runners to be at least 2 inches by 4 inches commercial thickness, minimum of three, except that two runners are authorized when width of case does not exceed 24 inches; or two runners may be used, minimum of 4 inches by 4 inches commercial thickness, when case does not exceed 36 inches in width. Runners to be bevelled at ends to facilitate use of rollers. Bottom boards, minimum of 1 inch commercial thickness, to be nailed across runners; bracing of parts and thickness of lumber to be sufficient to protect contents in transit.

Specification 15E

WOODEN BOXES, FIBREBOARD LINED

1. Compliance. (a) Required in all details.

2. Closed box. (a) Parts and pieces to be in close contact.

3. Ends. (a) Butt-joint glued to fibreboard. Plywood not authorized.

4. Sides, top and bottom. (a) Butt-joint or plywood glued to fibreboard.

5. Lumber. (a) To be well seasoned, commercially dry, and free from decay, loose knots, knots that would interfere with nailing, and other defects that would materially lessen the strength. Grain of wood in cleats must not cross cleat within ½ its length.

(b) Plywood, if used, shall be free of knots, decay, and other visible defects that interfere with the nailing. Plywood used must be of good commercial box or sheathing grade veneer.

6. Grouping of principal woods. (a) Grouping as follows:

Group 1

White pine	Chestnut	White fir
Norway pine	Sugar Pine	Cedar
Aspen (popple)	Cypress	Redwood
Spruce	Basswood	Butternut
Western (yellow) pine	Willow	Cucumber
Cottonwood	Noble fir	Alpine fir
Balsam Fir	Magnolia	Lodgepole pine
Yellow poplar	Buckeye	Jack pine
Red alder	Green ash	Red pine
Manitoba maple	Pine ponderosa	

Group 2

Southern yellow pine	North Carolina pine	Larch (tamarack)
Hemlock	Douglas fir	

Group 3

White elm	Pumpkin ash	Tupelo
Red gum	Black gum	Maple—soft or silver
Sycamore	Black ash	

Group 4

Hard maple	Hackberry	Hickory
Beech	Birch	White ash
Oak	Rock elm	

7. Width of pieces. (a) At least 2½".

8. Thickness of wood parts. (a) Thickness as follows:

Authorized gross weight of box not over (pounds)	Style of box (see Notes 2 and 3)	Minimum thickness (See note 1) of side, top and bottom in inches		Minimum thickness of end and cleats in inches		Minimum width of cleats in inches	Size of nails in ends (inch	
		Group 1 and 2	Group 3 and 4	Group 1 and 2	Group 3 and 4		Group 1 and 2	Group 3 and 4
150	1, 2, 2½	3/16	⅛	½	½	1¾	1½	1½
250	3 or 4 2½, 3 or 4	7/32	3/16	⅝	9/16	1⅞	1¾	1½
350	2½ or 3	¼	7/32	¾	11/16	2¼	2	1¾
450	2½ or 3	5/16	¼	25/32	25/32	2¼	2	1¾
550	2½ or 3	⅜	3/16	13/16	13/16	2½	2¼	2

NOTE 1: Plywood or paper covered wood veneer board of equal thickness and efficiency is permitted. Paper covered veneer board shall be of good quality Douglas fir core of at least 3/16 inch thickness, or lumber of equal quality, and free of breaks, gaps, holes, or knots. Paper covering shall be at least Kraft untreated linerboard having a basis weight of 42 pounds per 1,000 square feet and shall be secured to veneer core by adhesive in such manner as to form a satisfactorily laminated board.

NOTE 2: Thickness of ends in style 1 boxes shall be not less than 25/32↓↓ and load limit shall be not more than 100 pounds.

NOTE 3: Style 4 boxes shall have load limit of 200 pounds.

9. Assembly. (a) By nails, screws, staples or other devices of equal efficiency. Nails, screws and staples must be driven flush.

10. Nails and nailing. (a) Cement coated nails of size and with spacing detailed in para. 8, 11 and 12.

(b) At cleated edges drive at least 40 per cent of nails into cleats.

(c) Nails fastening cleats to ends be staggered and clinch ⅛"; uncoated nails authorized.

11. Nails; kind and dimensions. (a) Cement[1] coated of gauge and lenght as for "sinkers" and "coolers" as gener-

ally known to the trade; size in inches as prescribed in para. 8.

[1] Uncoated nails authorized when increased 25 per cent in number.

12. Nail spacing[1]. (a) Nail spacing follows:

Nails (size)	Maximum spacing when driven into end and cleats	
	Side grain	End grain
	Inches	Inches
1½-inch	1½	1¼
1¾-inch	1¾	1½
2-inch	2	1¾
2¼-inch	2¼	2

[1] To determine number of nails, divide length of nailing edge by spacing; fractions greater than ½ are considered as whole numbers. Each piece of sides, top and bottom shall be nailed to the ends with at least two nails through each end of the piece.

13. Classification of board. (a) Fibreboard is hereby classified by strength[3] of completed board as in first column of the following table; weights specified in the table are the minimum authorized:

Authorized gross weight of box not over (pounds)	Classified strength[3] of completed board	Solid fibreboard minimum combined weight of component plies exclusive of adhesives (pounds per 1,000 sq. ft.)	Facings for corrugated fibreboard double-faced minimum combined weight of facings (pounds per 1,000 sq. ft.)
150	200	190	84
250	275	237	138
350	325	237	138
450	350	283	180
550	375	283	180

[3] Mullen or Cady test (minimum).

14. Solid fibreboard. (a) To be 3-ply or more; both outer plies water resistant.

15. Corrugated fibreboard. (a) Both outer facings water resistant; corrugated sheets must be at least 0.009 inch thick and weigh not less than 26 pounds per 1000 square feet; all parts must be securely glued together throughout all contact areas.

16. Test. (a) Acceptable board must have prescribed strength, Mullen or Cady test, after exposure for at least 3 hours to normal atmospheric conditions (50 to 70 per cent relative humidity), under test as follows:

(1) Clamp board firmly in machine and turn wheel thereof at constant speed of approximately 2 revolutions per second.

(2) Six punctures required 3 from each side; all results but one must show prescribed strength.

(3) Board failing may be retested by making 24 punctures, 12 from each side; when all results but 4 show prescribed strength the board is acceptable.

(4) For corrugated fibreboard, double-pop tests may be disregarded.

17. Assembly. (a) The sheet of fibreboard to which are glued the boards forming the sides, top and bottom box sections, shall be properly scored to form a tube. The joint shall be on a side, top or bottom, near the center of the face, and located under one of the wood boards of the face.

(1) A water resistant glue shall be used to attach the fibreboard to the wood. The glue shall be applied in ribbons (lines) at right angles to the scores of the tube. The ribbons of glue shall be not less than 1¼″ wide and shall be spaced sufficiently close so that glue will cover not less than 25 per cent of the surface of the fibreboard. The ribbons of glue shall be equally spaced on the length of the box with the outside ribbons flush with the ends of the tube. Glue shall be applied to the fibreboard on the ends of the box in like amount as on the tube.

(2) For styles 2, 2½, and 3, all faces of the tube shall extend over the end boards and cleats. For style 4, all faces shall extend over the end boards, but only the side sections shall extend over the cleats.

(3) The boards between score lines, shall butt against each other when placed on the fibreboard, and the combined widths of the boards shall be approximately equal to the inside dimension of the respective box section so that the boards completely cover the fibreboard between the inside edges of adjacent scores.

(4) A sheet of fibreboard shall be attached to each end as provided in paragraph (a)(1) of this section and shall completely cover the inside of the end.

18. Closing for shipment. (a) Box shall be securely closed. Nails, if used, shall be as prescribed in paragraphs 8, 10, 11 and 12.

19. Marking. (a) Marking on each box with letters and figures at least ½″ high in rectangle as follows:

CTC-15E***

(1) The stars must be replaced by authorized gross weight (for example, CTC-15E100, etc.). This mark shall be understood to certify that box complies with all specification requirements.

Specification 15L

WOODEN BOXES WITH INSIDE CONTAINERS FOR DESENSITIZED LIQUID EXPLOSIVES

1. Compliance. (a) Required in all details.

2. Size and capacity. (a) Each outside wooden container shall contain not more than one inside metal container having a capacity not to exceed 10 quarts.

3. Outside containers. (a) Wooden boxes cleated as prescribed. Parts must be in close contact and completely enclose inside containers. Lumber must be well seasoned, commercially dry, and free from decay, loose knots that would interfere with assembly, or other defects that materially lessen the strength.

(b) Assembly: Use brass screws throughout. Assemble sides and ends with grain of wood vertical. Fasten bottom securely with edges flush with sides and ends of box. Cleats must extend around entire perimeter of box. Apply top and bottom cleats horizontally. Bottom cleats

must be flush with bottom surface of the box. Top cleats must extend above top of box to provide a ¾-inch recess for cover projections (see sec. 5). Cover must be flush with outside surface of top cleats and must be cleated on the outside at all edges. Cleats may be mitered but must butt at all corners.

(c) Parts and dimensions as follows:

Minimum dimensions			
Thickness, sides, top, bottom, and ends	Top cleats	Bottom cleats	Cover cleats
⅛″	⅝″ × 3½″	⅝″ × 2¾	¾″ × 2″

4. Inside containers. (a) Inside containers must be as follows:

(1) Metal containers. Double seamed, of copper weighing not less than 16 ounces per square foot, or other non-sparking material of equivalent strength. All seams must be closed by welding, brazing, or soldering so as to be tight against leakage. Handles must be fastened to top of container and be of copper weighing not less than 48 ounces per square foot, or other nonsparking material of equivalent strength. Each side of the container must be strengthened vertically by at least three equally spaced indented crimps. Each container must have two pouring spouts in the top securely closed by rubber stoppers.

(2) Rubber liners. Each inside metal container must be inserted in a two-piece rubber liner or boot, consisting of a cover and body, into which it must fit snugly and which in turn shall fit snugly the outside wooden container. This liner must be watertight and of such size as to fully protect the inside container. Sides of liner must be at least ¼ inch in thickness and bottom at least ½ inch in thickness. Top edge of boot must be flanged to fit the recess provided by the top cleats on the outside wooden container and such flange must be at least ⅜ inch thick exclusive of any channels or indentations necessary to effect satisfactory closure because of projections on cover. Cover must be not less than ½ inch in thickness including projections for securing rubber stoppers in metal containers, and must have a formed moulding around its entire perimeter to match and tightly fit channels or indentations in the body flange.

(b) Tests. Each inside metal and rubber container must be adequately tested and inspected during manufacture to insure against leakage.

5. Closure. (a) Top of rubber liner must be firmly fastened to wooden cover of outside container so as to fit securely into ¾ inch recess provided by top cleats on box. Top of liner must have projections on the inside which bear directly on rubber stoppers of metal containers to secure them in place. When closure is effected the liner must provide a positive seal against interior leakage. Cover of wooden outside container must be securely fastened to body of container by means of trunk clasps affixed to each face of the box. The trunk clasps must be recessed into cover and top cleats to furnish a smooth bearing surface on all faces of the box.

6. Marking. (a) Marking on each box with letters and figures at least ½-inch high in rectangle as follows:

CTC-15L

(1) This mark shall be understood to certify that box complies with all specification requirements.

Specification 15M

WOODEN BOXES

Metal lined, with inside containers for desensitized liquid explosives.

1. Compliance. (a) Required in all details.

2. Size and capacity. (a) Each outside wooden container shall contain not more than 6 inside metal containers having nominal capacity of 8 quarts each.

3. Outside containers. (a) Wooden boxes cleated as prescribed. Parts must be in close contact and completely enclose inside containers. Lumber must be well seasoned, commercially dry, and free from decay, loose knots, knots that would interfere with assembly, or other defects that materially lessen the strength.

(1) The box shall be lined with copper or other nonsparking metal having suitable strength. All seams must be soldered, welded or brazed to produce a liquid-tight container having no openings in the bottom, sides, or ends.

(b) Assembly: Use brass screws throughout, countersunk and with heads covered with suitable wood filling compound. Any screw used to secure a metal attachment shall be soldered, welded, or brazed thereto. Metal parts used in the construction of or attached to the box or cover must be of nonsparking type. Fasten bottom securely with edges flush with sides and ends of box. Cleats must extend around entire perimeter of box. Apply top and bottom cleats horizontally. Bottom cleats must be flush with bottom surface of the box. Top cleats must extend above top of box to provide a ¾″ recess for cover projections (para. 5). Cover must be flush with outside surface of top cleats. Cleats may be mitered but must butt at all corners.

(c) Cellular construction. The interior of the box shall be divided into cells by means of removable, nonmetallic, nonsparking dividers, into which the rubber boots or secondary containers fit snugly. The cells shall be of such size as to extend from the bottom to near the top of the rubber boots or secondary containers.

(d) Parts and dimensions as follows:

Minimum dimensions in inches			
Thickness, sides, top, bottom, and ends	Top cleats	Bottom cleats	Cover cleats
¾	⅝ × 3½	⅝ × 2¾	¾ × 2

4. Inside containers. (a) Inside containers must be as follows:

(1) Metal containers. The individual inside containers shall be made in a workmanlike manner, of copper or other

nonsparking material of suitable strength, with all seams soldered, welded, or brazed to be liquid tight. The top shall be fitted with a securely attached carrying handle of copper or other nonsparking material of suitable strength. Each inside container must have a filling and pouring spout in the top, which shall be securely closed with rubber stoppers, paraffin, or oil-treated corks or other nonmetallic, nonsparking closures which are resistant to absorption of the contents and which provide a leakproof seal. The closures shall be secured in such manner as to prevent loosening, displacement, and leakage of contents during transit. Each inside container may have sufficient capacity in excess of 8 quarts to provide for outage requirements. Each side of the container must be strengthened vertically by at least 3 equally spaced indented crimps.

(2) Rubber boots or secondary containers. Each inside metal container must be contained in a rubber boot or other similar suitable leakproof, nonmetallic, nonabsorbent outer container, which must fit snugly in cellular structure provided in paragraph 3(c). The rubber boot or secondary container must be liquid tight and shall be so constructed as to have an inside height approximately that of the inside metal container plus closure and otherwise so constructed that the bottom will provide cushioning for the inner container.

(b) Tests. Each inside metal and rubber or secondary container must be so adequately tested and inspected during manufacture to insure against leakage.

5. Closure. (a) The box cover must be securely fastened to the box in a manner to prevent movement of the inside containers. The inner surface of the box cover must be lined with suitable coating material or sheathed with nonsparking metal to provide a nonabsorbent surface. The cover must be secured to the box by means of nylon, or other suitable straps, and be so positioned to furnish a smooth bearing surface on all faces of the box. There shall be no protruding parts on the box or cover which would result in metal-to-metal contact.

6. Marking. (a) Marking on each box with letters and figures at least ½″ high in rectangle as follows:

CTC-15M

(1) This mark shall be understood to certify that box complies with all specification requirements.

Specification 15P

GLUED PLYWOOD OR WOODEN BOX

For Inside Containers

1. Material requirements. (a) Lumber or plywood must be well seasoned, commercially dry, and free from decay, loose knots, knots that would interfere with nailing, and other defects that would materially lessen the strength and in accordance with the following:

(1) Lumber must be of good commercial grade.

(2) Plywood sections shall be firmly glued together with waterproof glue. A section of plywood from any part when immersed in water at room temperature for 48 hours shall show no delamination or separation of plies to qualify glue as waterproof.

2. Construction requirements. (a) Box shall be constructed of wood or of plywood not less than three-ply fabrication and shall be constructed so as to completely and snugly enclose body of the inside container, and so formed that inside container cannot permanently change position and be of sufficiently strong wood or plywood to withstand prescribed tests without serious rupture of or damage to box that would cause failure or lead to impending failure of inside container.

NOTE 1: Vertical openings not exceeding ⅜ inch in width and extending to within 3 inches of top bottom on two opposite sides of box are permitted.

(b) Specifications for the outside container must be filed with and approved by the Commission or Bureau of Explosives.

3. Tests. (a) One sample, taken at random and with inner container filled to marked capacity with water and closed as for use, shall be capable of withstanding prescribed tests without leakage. Tests shall be made of each size by each company starting production. The type tests are as follows:

(1) Complete package must be capable of withstanding two drops from a height of 4 feet onto solid concrete, the first drop to be made diagonally so top corner will strike the concrete; the second drop onto a 2 inch by 6 inch timber resting on the concrete with the 6 inch leg vertical, the drop being made with the box in a horizontal position and at right angles to the timber so that impact is near the centre of the box side-wall.

(2) Additional tests as required by inside container specification.

4. Marking. (a) Each outside container must be plainly marked with letters and figures at least ¾ inch high applied by hot branding iron or dark colored printing ink with pressure dies as follows:

(1) CTC-15P. This mark shall be understood to certify that the complete outer package complies with all specification requirements.

(2) Name or symbol (letters) of company setting up the package, or other party assuming responsibility for its compliance with the specification requirements; this must be registered with the Bureau of Explosives through the Commission and located just above or below the mark specified in paragraph (a)(1) of this section.

Specification 15X

WOODEN BOXES

For two five-gallon cans

1. Compliance. (a) Required in all details.

2. Closed box. (a) Parts and pieces to be in close contact.

3. Ends. (a) To be of group I, II, or III wood not over 2-piece.

4. Sides, top and bottom. (a) To be of Group I, II, or III wood, not over 3-piece.

5. Two-piece ends and corrugated fasteners—(a) Two-piece ends. Joints must be fastened with at least 3 corrugated fasteners.

(b) Corrugated fasteners. To be 1″ wide and with penetration of ½ inch.

6. Lumber. (a) To be well seasoned, commercially dry, and free from decay, loose knots, knots that would interfere with nailing, and other defects that would materially lessen the strength.

7. Groupings of principal woods. (a) Grouping as follows:

Group I

White pine	Chestnut	White fir
Norway pine	Sugar pine	Cedar
Aspen (popple)	Cypress	Redwood
Spruce	Basswood	Butternut
Western (yellow) pine	Willow	Cucumber
Cottonwood	Noble fir	Alpine fir
Balsam fir	Magnolia	Lodgepole pine
Poplar	Buckeye	Jack pine
Red alder	Green ash	Red pine
Manitoba maple	Pine ponderosa	

Group II

Southern yellow pine	Hemlock	Douglas fir
Larch (tamarack)	North Carolina pine	

Group III

White elm	Pumpkin ash	Tupelo
Red gum	Black gum	Maple, soft or silver
Sycamore	Black ash	

8. Width of pieces. (a) At least 2″ for sides, top and bottom if in two pieces, or 2⅜″ for tops and bottoms and at least 4″ for sides if in three pieces.

9. Thickness of lumber. (a) Thickness as follows:

(1) Ends: Thickness to be not less than ¾″ for Group I or II lumber and 11/16″ for Group III lumber.

(2) Sides, top and bottom: Thickness to be not less than ⅜″

10. Assembly. (a) By nailing with either bright or cement-coated nails, size and spacing as follows:

(1) Top to each end: 5 nails (1½″ by 12½ gauge).

(2) Bottom to each end: 6 nails (1¾″ by 12 gauge).

(3) Sides to each end: 6 nails (1½″ by 12½ gauge).

11. Marking. (a) Marking on each box in letters and figures at least ½″ high in a rectangle as follows:

CTC-15X

(1) This mark shall be understood to certify that box complies with all specification requirements.

12. Inside can. (a) Size: Approximate dimensions 9⅜ × 9⅜ × 13 15/16 inches.

(b) Approximate capacity: 1,118 cu. in.

(c) Top: Embossed
Seams: Crimped and soldered.
Closure: Airtight and leakproof.
Handles: Wire.

(d) Bottom: Embossed.
Seams: Crimped and soldered.

(e) Body: Panelled on 4 sides.
Two seams: Clinched and soldered.

(f) Material: 1C (107 lb.) tin or terne-plate.

(g) Average weight: 2 pounds 8 ounces.

(h) Marking: No specification marking required.

Specification 16A

PLYWOOD OR WOODEN BOXES WIREBOUND

1. Compliance. (a)Required in all details. Authorized tolerances. Cleats, battens, and handles, minus 1/32″; single thickness veneer, minus 5 per cent; resawn boards, 1/64″ below specified thickness for boards up to 7/32″ thick and 1/32″ below specified thickness for boards ¼″ or more thick.

2. Lumber or plywood. (a) Lumber shall be well seasoned and commercially dry; free from decay, objectionable knots, slanting shakes, sharp cross grain, and other defects that materially lessen the strength. Grain of wood in cleats and battens must not cross piece within its length.

(b) Plywood shall be made from veneer which has been rotary cut, sliced, or sawed. Plywood shall be good commercial box or sheathing grade and shall be moisture-resistant; free from decay, objectionable knots that interfere with nailing, splits, gaps, and other defects that materially lessen the strength.

(1) Moisture-resistant plywood shall be fabricated with either synthetic or protein type glue. Specimens for testing shall be not less than 5 in number, measuring 6″ × 6″, and shall withstand 10 cycles of 4 hours immersion in water at room temperature and drying for 20 hours at a temperature not over 100°F. After 10 cycles, 4 of the 5 samples are to show not more than a sum total of 2-inch delamination on the edges, with depth delamination no greater than ½ inch.

3. Wires. (a) Of annealed steel, or other metal of equal strength, Washburn and Moen sizes.

4. Staples. (a) Wire size, Washburn and Moen.

5. Grouping of principal woods. (a) Grouping as follows:

Group 1

White pine	Chestnut	White fir
Norway pine	Sugar pine	Cedar
Aspen (popple)	Cypress	Redwood
Spruce	Basswood	Butternut
Western (yellow) pine	Noble fir	Alpine fir
Cottonwood	Willow	Cucumber
Poplar	Magnolia	Lodgepole pine
Balsam fir	Buckeye	Jack pine
Red elder	Green ash	Red pine
Manitoba maple	Pine ponderosa	

Group 2

Southern yellow pine	North Carolina pine	Larch (tamarack)
Hemlock	Douglas fir	

Group 3

White elm	Pumpkin ash	Tupelo
Red gum	Black ash	Maple—soft or silver
Sycamore	Black gum	

Group 4

Hard maple	Hackberry	White ash
Beech	Birch	Hickory
Oak	Rock elm	

6. Closed box. (a) Parts and pieces with edges in close contact to give completely closed box.

7. Top, sides, and bottom. (a) Each cleated at both ends; intermediate rows of cleats authorized.

8. Cleats. (a) Ends mitered or with mortise and tenon joints.

(b) Cleats for plywood boxes shall be Group 4 woods.

9. Ends. (a) Battened when prescribed. Wired ends authorized provided wires run cross grain and terminate in loops with ends of wire driven through end board and clinched. Grain of wood and outside ply of plywood shall be perpendicular to sides except for wired ends.

(b) As provided by sec. 73.65(a)(1) Note 1, wooden boxes, having inside metal containers which are tighly and securely closed may be equipped with hand holes in each end which must be not more than one inch by four inches and centred laterally not nearer than 1⅝ inches from top edge of end of box.

10. Wires. (a) One wire over each row of cleats; intermediate wires as prescribed.

11. Stapling. (a) Staples for wires over cleats driven through boards into cleats and anchored; others through boards and clinched.

12. Thickness of boards or plywood (sides, tops, bottoms, and ends). (a) Thickness as follows except that, for thicknesses described as 3/16″ or less, resawn boards must be 1/16″ thicker for each resawn surface:

Group of wood	Minimum thickness of boards (inch)						
	⅛ (0.125)	1/7 (0.143)	1/6 (0.167)	3/16 (0.188)	7/32 (0.219)	¼ (0.250)	5/16 (0.313)
	Authorized gross weight, box and contents, not over (pounds)						
1	25	35	50	75	100	150	200
2	35	50	75	100	150	200	315
3	50	75	100	150	200	315	400
4	75	100	150	200	315	400	.....

(1) For boxes with 3 or more rows of cleats, boards of the next lower thickness prescribed in the table are acceptable.

Note 1: The gross weight of boxes fabricated from 1/6″ Canadian Birch may be increased to 200 pounds.

(b)

Group of wood	Minimum thickness of plywood (inch)[1]		
	⅛ (0.125)	3/20 (0.150)	3/16 (0.188)
	Authorized gross weight, box and contents, not over (pounds)		
4	150	300	400

[1] Minimum tolerance of 5% permitted for specified thicknesses.

13. Size of cleats. (a) At least 13/16″ by 13/16″ when thickness required for boards exceeds 1/7″; otherwise at least 3/16″ by 11/16″.

14. Binding wires (sides, top, and bottom). (a) Spacing not over 8″.

Exception: When each binding wire is stapled to a row of cleats, 11″ spacing is authorized.

(b) Number and size of binding wires as follows:

Number of wires	Minimum gauge of wires, Washburn and Moen				
	16	15	14	13	12
	Authorized gross weight, box and contents (pounds)				
2	35	50	75	100	150
3	50	75	100	150	200
4	75	100	150	200	315
5	100	150	200	315	400
6	.....	200	315	400	.....
7	.....	.....	400	.....	.....

15. Wires for wired ends. (a) At least 2 wires on each end, size not less than as specified for binding wires in sec. 14, and spaced as follows:

Thickness of end (inch)	Maximum spacing	
	Between wires (inch)	Wires to cleats (inch)
0.125	6	4
.143	6	4
.167	6½	4
.187	6½	4
.219	7	4
.250	7	4
.313	7	4

(b) Ends less than 10 inches deep are authorized with 1 wire provided they are reinforced by 2 strips (liners), at least 1¼″ wide and as thick as ends, securely stapled along edges of the end parallel to the wires.

16. Staple spacing (approximate) and minimum size. (a) Staples into cleats 16 gauge, Washburn and Moen, and:

(1) One and one-fourth inches long with 1½″ spacing, or 1⅛″ long with 1″ spacing, when boards are over ¼″ thick.

(2) One and one-eighth inches long with 1½″ spacing, for boards ¼″ thick or less; except that staples ⅞″ long with 1½″ spacing are authorized when boards are 1/7″ thick or less.

(b) Other staples 18 gauge, Washburn and Moen.

17. End supporting battens[1]. (a) End supporting battens at least 1⅛″ wide and same thickness as cleats; featened securely across ends parallel to side cleats; required so that unsupported distance between cleats, battens, and between cleats and battens will be not greater than as follows.

Thickness of ends (inch):	Maximum spacing (inches)
0.125	10
0.143	11
0.167	12
0.187	13
0.219	14
0.250	15
0.313	16

[1] Not required for wired ends less than 20 inches long.

18. Side cleat battens and wired end supports—(a) Side cleat battens. At least 13/16″ by 13/16″; fastened securely to ends so as to be adjacent to side cleats when box is set up; required, in addition to any other battens, when authorized gross weight exceeds the following:

Group of wood in cleats:	Authorized gross weight, box and contents, over (pounds)
1	100
2	150
3	200
4	200

(b) Wired end supports. Wired ends, for boxes for authorized gross weight exceeding the foregoing, must be reinforced by 2 strips (liners), at least 1¼″ wide and as thick as ends, securely stapled along edges of the end parallel to the wires; side cleat battens not required.

19. Marking. (a) Marking on each box with letters and figures at least ½″ high in rectangle as follows:

CTC-16A-C

(1) Stars must be replaced by maximum authorized gross weight (for example, CTC-16A150, etc.). This mark shall be understood to certify that box complies with all specification requirements.

(b) Name of maker located just above, below, or following the mark specified in paragraph (a) of this section; symbol (letters) authorized if registered with the Bureau of Explosives through the Commission.

20. Setting up and closing. (a) Nail or staple unwired ends to side cleats at intervals not over 2½″; fasten wired ends securely by means of loop fasteners.

(b) Twist ends of binding wires or bend loops to give tight closure.

(c) Nail at least 2 nails through side cleats into each side-cleat batten at nor over 4″ intervals; nail through top and bottom cleats with one 2¼-inch nail into each end of end-supporting battens.

22. Special box authorized only when used in conjunction with inside specification 2U polyethylene 5 and 12½ gallon cubical containers.

(a) The boxes shall comply with spec. 16A requirements using the table for a gross weight of 200 pounds for construction purposes only, except as follows:

(1) The top section of boxes may have a hole not over 4⅛ inches in diameter midway between the cleats, and centered not less than 3 1/16 inches from either the back or front edge of boxes.

(2) Five-gallon capacity—ends. Ends may be made from ⅛ inch or thicker veneer and have only one 14-gauge wire across face. One-eighth inch veneer liners, at least 1¼ inches wide, must be stapled across the top and bottom of the ends.

(i) Twelve and one half gallon capacity—ends. Ends must be made with same thickness faceboard material as the sides, top, and bottom and must have two liners of the same thickness, at least 3 inches wide, fastened by two rows of staples. Ends may have one 13-gauge wire across face.

(3) Paper overlaid veneer having veneer core of group 3 or 4 wood and completely covered on each side with 42 pound basis weight kraft paper securely adhered thereto by moisture resistant adhesive, is authorized. Total combined thickness of finished board shall be not less than 0.160 inch.

(4) Wire spacing for 5-gallon capacity containers. Binding wires stapled to a row of cleats may be spaced not more than 13 inches apart.

(b) Wirebound wooden or paper overlaid veneer board boxes must be provided with full size double-faced corrugated liners of at least 125-pound test (Mullen or Cady) for bottom and sides. Full area top pad is required for 5-gallon capacity containers and must be a minimum of 200-pound test (Mullen or Cady). Full area top pad is required for the 12½-gallon capacity container and must be a minimum of 275-pound test (Mullen or Cady).

(c) Marking required:

(1) Marking on each box with letters and figures at least ½ inch high in rectangle as follows:

CTC-16A-C

(2) This mark shall be understood to certify that outer container complies with all construction requirements of the specification.

(3) Name of maker shall be located just above, below, or following the mark specified in subparagraph (1) of this paragraph; symbol (letters) authorized if registered with the Bureau of Explosives through the Commission.

Specification 16B

WOODEN BOXES—WIREBOUND

1. Compliance. (a) Required in all details. Authorized tolerances: Cleats, battens, and handles, minus 1/32″; single thickness veneer, minus 5 per cent; resawn boards, 1/64″ below specified thickness for boards up to 7/32″ thick and 1/32″ below specified thickness for boards ¼″ or more thick.

2. Lumber. (a) Well seasoned and commercially dry; free from decay, objectionable knots, slanting shakes, sharp cross grain, and other defects that materially lessen the strength. Grain of wood in cleats and battens must not cross piece within its length.

3. Wires. (a) Of annealed steel, or other metal of equal strength, Washburn and Moen sizes.

4. Staples. (a) Wire size, Washburn and Moen.

5. Grouping of principal woods. (a) Grouping as follows:

Group I

White pine	Chestnut	White fir
Norway pine	Sugar pine	Cedar
Aspen (popple)	Cypress	Redwood
Spruce	Basswood	Butternut

Western (yellow) pine	Noble fir	Alpine fir
Cottonwood	Willow	Cucumber
Poplar	Magnolia	Lodgepole pine
Balsam fir	Buckeye	Jack pine
Red alder	Green ash	Red pine
Manitoba maple	Pine ponderosa	

Group 2

Southern yellow pine	North Carolina pine	Larch (tamarack)
Hemlock	Douglas fir	

Group 3

White elm	Pumpkin ash	Tupelo
Red gum	Black ash	Maple—soft or silver
Sycamore	Black gum	

Group 4

Hard maple	Hackberry	White ash
Beech	Birch	Hickory
Oak	Rock elm	

6. Closed box. (a) Parts and pieces with edges in close contact to give completely closed box except that spaces 1½″ are authorized between side boards and between top boards when boards are at least 3½″ wide.

(b) Handles: Containers may be provided with suitable handles at discretion of shipper. When used, they must be securely fastened along tops of sides under wires and project 3 inches or be mounted on end cleats; extensions of side boards acceptable; dimensions as follows:

Authorized gross weight not over (pounds):	Handles[1] minimum cross section (inches)
150	½ × 2½
200	⅝ × 2½
315	⅝ × 3½
400	13/16 × 3½

[1] Also ridge reinforcing battens when prescribed.

7. Top, sides, and bottom. (a) Each cleated at both ends; intermediate rows of cleats authorized.

8. Cleats. (a) Ends mitered or with mortise and tenon joints.

9. Ends. (a) Battened when prescribed. Wired ends authorized provided wires run across grain and terminate in loops with ends of wire driven through end board and clinched. Grain of wood perpendicular to sides except for wired ends. Ridge-top containers, authorized as follows:

(1) Ends must be at least 2 times as thick as prescribed in sec. 12.

(2) Unsupported distance as prescribed in para. 17 must not exceed 10″ in any case.

(3) Ridge over 30″ long must be reinforced on the outside, from end to end, by 2 battens with abutting edges and of cross section as prescribed for handles.

(4) Vertical grain unwired ends are authorized.

10. Wires. (a) One wire over each row of cleats; intermediate wires as prescribed.

11. Stapling. (a) Staples for wires over cleats driven through boards into cleats and anchored; others through boards and clinched.

12. Thickness of boards (sides, tops, bottoms, and ends): (a) Thickness as follows except that, for thicknesses prescribed as 3/16″ or less, resawn boards must be 1/16″ thicker for each resawn surface:

Group of wood	Minimum thickness of boards (inch)						
	⅛ (0.125)	1/7 (0.143)	1/6 (0.167)	3/16 (0.188)	7/32 (0.219)	¼ (0.250)	5/16 (0.313)
	Authorized gross weight, box and contents (pounds)						
1	25	35	50	75	100	150	200
2	35	50	75	100	150	200	315
3	50	75	100	150	200	315	400
4	75	100	150	200	315	400	

(b) For boxes with 3 or more rows of cleats, boards of the next lower thickness prescribed in the table are acceptable.

13. Size of cleats. (a) At least 13/16″ by 13/16″ when thickness required for boards exceeds 1/7″; otherwise at least 9/16″ by 13/16″.

14. Binding wires (sides, top, and bottom). (a) Spacing not over 8″.

Exception: When each binding wire is stapled to a row of cleats, 11″ spacing is authorized.

(b) Number and size of binding wires as follows:

Number of wires	Minimum gauge of wires, Washburn and Moen				
	16	15	14	13	12
	Authorized gross weight, box and contents (pounds)				
2	35	50	75	100	150
3	50	75	100	150	200
4	75	100	150	200	315
5	100	150	200	315	400
6		200	315	400	
7			400		

15. Wires for wired ends. (a) At least 2 wires on each end, size not less than as specified for binding wires in para. 14, and spaced as follows:

Thickness of end (inch)	Maximum spacing	
	Between wires (inch)	Wires to cleats (inch)
0.125	6	4
.143	6	4
.167	6½	4
187	6½	4
.219	7	4
.250	7	4
.313	7	4

(b) Ends less than 10 inches deep are authorized with 1 wire provided they are reinforced by 2 strips (liners), at least 1¼″ wide and as thick as ends, securely stapled along edges of the end parallel to the wires.

16. Staple spacing (approximate) and minimum size. (a) Staples into cleats 16 gauge, Washburn and Moen, and:

(1) One and one-fourth inches long with 1½″ spacing, or 1½″ long with 1″ spacing, when boards are over ¼″ thick.

(2) One and one-eighth inches long with 1½″ spacing, for boards ¼″ thick or less; except that staples ⅞″ long with 1½″ spacing are authorized when boards are 1/7″ thick or less.

(b) Other staples 18 gauge, Washburn and Moen.

17. End supporting battens.[1] (a) At least 1½″ wide and same thickness as cleats; fastened securely across ends parallel to side cleats; required so that unsupported distance between cleats, battens, and between cleats and battens will be not greater than as follows:

Thickness of ends (inch):	Maximum spacing (inches)
0.125	10
0.143	11
0.167	12
0.187	13
0.219	14
0.250	15
0.313	16

18. Side cleat battens and wired end supports—(a) Side cleat battens. At least 13/16″ by 13/16″; fastened securely to ends so as to be adjacent to side cleats when box is set up; required, in addition to any other battens, when authorized gross weight exceeds the following:

Group of wood in cleats:	Authorized gross weight, box and contents, over (pounds)
1	100
2	150
3	200
4	200

(b) Wired end supports. Wired ends, for boxes for authorized gross weight exceeding the foregoing, must be reinforced by 2 strips (liners), at least 1¼″ wide and as thick as ends, securely stapled along edges of the end parallel to the wires; side cleat battens not required.

19. Marking. (a) Marking on each box with letters and figures at least ½″ high in rectangle as follows:

CTC-16B***

(1) Stars must be replaced by maximum authorized gross weight (for example, CTC-16B315, etc.). This mark shall be understood to certify that box complies with all specification requirements.

(b) Name of maker located just above, below, or following the mark specified in paragraph (a) of this section; symbol (letters) authorized if registered with the Bureau of Explosives through the Commission.

20. Setting up and closing. (a) Nail or staple unwired ends to side cleats at intervals not over 2½″; fasten wired ends securely by means of loop fasteners; Provided, that ends at least 7/16″ thick may be nailed with cement-coated nails through sides, top, and bottom of box into the ends at 3″ intervals.

(b) Twist ends of binding wires or bend loops to give tight closure.

(c) Nail at least 2 nails through side cleats into each side cleat batten at not over 4″ intervals; nail through top and bottom cleats with one 2¼-inch nail into each end of end-supporting battens.

[1] Not required for wired ends less than 20 inches long.

21. Special Box. (a) Gross weight not over 500 pounds. Must comply with this specification except as follows: Sides, top, bottom, and ends, to be of group 2 or 3 wood having minimum thickness of ¼″ for boxes not over 315 pounds gross weight, 5/16″ for boxes not over 400 gross weight, and ⅜″ for boxes not over 500 pounds gross weight. Size of end cleats must be at least 13/16″ × ⅞″ and ends must have horizontal supporting battens at least 1⅜″ × 13/16″. One batten is required for boxes not over 200 pounds gross weight and three battens for others. Ends must be held in place by one metal strap at least ⅝″ × 0.020″ completely around the box stapled to the middle end battens. When size of box will not permit the application of all prescribed binding wires during manufacture, the additional binding wires of prescribed number and size, or metal straps of equal number and strength, must be applied after closing. At least three binding wires must be applied to boxes not over 200 pounds gross weight and at least four to boxes over 200 pounds gross weight by the box manufacturer. Binding wires for boxes over 400 pounds gross weight must be of size and number prescribed for boxes not over 400 pounds gross weight.

Specification 16D

WOODEN WIREBOUND OVERWRAP

For inside containers

1. Material requirements. (a) Lumber shall be as follows:

(1) Lumber shall be well seasoned and commercially dry; free from decay, objectionable knots, slanting shakes, sharp cross grain, and other defects that materially lessen the strength. Grain of wood in cleats and battens must not cross piece within its length.

(2) Authorized tolerances; cleats, battens and handles, minus 1/32 inch; single thickness veneer, minus 5 per cent; resawn boards, 3/64 inch below specified thickness for boards up to 7/32 inch thick and 1/32 inch below specified thickness for boards ¼ inch or more thick.

(3) Woods authorized are in the following groups:

Group 2		
Southern yellow pine	North Carolina pine	Larch (tamarack)
Hemlock	Douglas fir	
Group 3		
White elm	Pumpkin ash	Tupelo
Red gum	Black ash	Maple-soft or silver
Sycamore	Black gum	
Group 4		
Hard maple	Hackberry	White ash
Beech	Birch	Hickory
Oak	Rock elm	

(b) Binding wires and staples shall be as follows:

(1) Of annealed steel or other material of equal strength, Washburn and Moen sizes.

2. Construction requirements. (a) Wirebound overwrap for drum type inside container shall be constructed in accordance with the following:

Wirebound containers	Marked capacity of inside containers: Not over 5 gallons	Not over 12½ gallons	Not over 25 gallons	Not over 46 gallons
Faceboard thickness (sides only)				
Group 2 woods	1 8" Veneer	1 4" Resawn	5 16" Resawn	3 8" Resawn
Group 3 or 4 woods	1 4" Veneer	1/4" Resawn	1/4" Resawn	3 8" Resawn
Cleats mitered				
Outside cleats				
Group 2, 3, or 4 woods	13 16" x 7 8"	13 16" x 7 8"	13 16" x 7 8"	13 16" x 7 8"
Binding wires				
Number and gauge over outside cleats	2-14 gauge	2-12 gauge	2-11 gauge	2-11 gauge
Number and gauge intermediate wires	1-14 gauge	3-12 gauge	4-12 gauge	3-12 gauge 2-11 gauge
Staples (length, gauge and spacing)				
In outside cleats	1 1 8"-16 gauge	1 1 8"-16 gauge	1 1 8"-16 gauge	1 1 8"-16 gauge
Over intermediate wires	3 8"-18 gauge	7 16"-18 gauge	7/16"-18 gauge	9/16"-18 gauge
Maximum space between staples	13 4"	13 4"	13 4"	13/4"
Top and Bases (Groups 2, 3, or 4 woods)				
Faceboard thickness	1 4" Resawn	3 8" Resawn	9 16"	13 16"
Battens (2 required)	13 8" x 1 4"	13 16" x 7 8"	13 16" x 7 8"	15 8" x 7 8"
Staples or cement coated nails	11 16"-18 gauge	1 1/4"-16 gauge	22-4d nails	13 4"-14 gauge

Wirebound containers	Marked capacity of Inside containers: Not over 51 2 gallons (rectangular overwrap)	Not over 11 gallons (rectangular overwrap)	Not over 11 gallons (cylindrical overwrap)
Faceboard thickness (sides only)			
Group 2 woods	5 16"	3 8"	3 8"
Group 3 woods	1 4" Resawn	5 16"	5/16"
Group 4 woods	1/4" Resawn	5 16"	5 16"
Cleats			
Outside and interrupted cleats	13 16" x 7 8"	13 16" x 7 8"	13 16" x 5 8"
Intermediate cleats	51 2" x 3 8"	51 2" x 3 8"	Outside cleats only
Binding wires			
Number and gauge over outside cleats	2-13 gauge	2-12 gauge	2-12 gauge
Number and gauge over intermediate cleats or intermediate wires	2-14 gauge (not over 5 gallons) 4-14 gauge (not over 61 2 gallons)	4-13 gauge	2-12 gauge
Staples			
In outside and interrupted cleats	1 1 4"-16 gauge	1 1 4-16 gauge	1 1 8"-16 gauge
In intermediate cleats	7 8"-16 gauge	7 8"-16 gauge	None
Over intermediate wires	7 16"-18 gauge	1 2"-18 gauge	
NOTE: A 2" gap between staples must be provided in the centre of each line of staples over the intermediate cleats.			No. 2" gap in staples required
Top[1]			
Face material thickness	9 16"	13 16"	9 16"
Battens	13 8" x 9 16"	17/8" x 13/16"	7 8" x 3 16"
Base			
Base material thickness	3 8"	3 8"	9 16"
Edge strips	11 4" x 3 8"	31 8" x 3 8"	7 8" x 13 16"
Centre strips	31 8" x 3 8"	31 8" x 3 8"	(Battens)

[1] A hole of suitable type may be left in top of box to provide for protruding neck of inner container

[2] Exterior grade plywood 1 2" thick with no battens is authorized

(1) Staples for wires over cleats driven through boards into cleats and anchored; others through boards and clinched.

(2) Container shall be closed with threaded loop fastener with "Z" clinch for all capacities except 5 gallon for which regular clinch is authorized.

(3) Where binding wire closure clinches contact inner container, 1½ inches wide water-resistant fabric cloth with plastic coated backing and pressure-sensitive adhesive or other suitable means shall be applied in a single strip across clinches, or other equally efficient methods may be used.

(b) Wirebound overwrap for bottle-type inside container shall be constructed as shown in table.

(1) Containers shall be closed with threaded loop fasteners using a regular clinch.

3. Assembly. (a) Overwrap shall be constructed to provide a snug fit for the inside container.

(b) Overwrap inside surfaces shall be reasonably smooth and free from projections which would damage inside container.

4. Tests. (a) Wirebound overwrap; when assembled as for use, shall withstand the tests prescribed for specified inside containers. The completed package must withstand these tests without serious rupture of the overwrap and without producing a condition of the overwrap that could result in potential damage to the inside container.

5. Marking authorized. (a) Marking on each overwrap with letters and figures at least ½ inch high in rectangle as follows:

CTC—16D

(b) This mark shall be understood to certify that outer container complies with all construction requirements of the specification.

(c) Name of maker shall be located just above, below, or following the mark specified in paragraph (a) of this section; symbol (letters) authorized if registered with the Bureau of Explosives through the Commission.

Specification 17C
STEEL DRUMS

Single-Trip container. Removable head containers which will pass all required tests are authorized.

1. Compliance. (a) Required in all details.

2. Rated capacity. (a) Rated capacity as marked, see para. 10(a)(3). Minimum actual capacity of containers shall be not less than rated (marked) capacity plus 3½ per cent. Maximum actual capacity shall not be greater than rated (marked) capacity plus 5 per cent or rated (marked) capacity plus 4 per cent plus 1 quart whichever is the greater.

3. Composition. (a) Sheets for body and heads to be low, carbon, open-hearth or electric steel.

5. Seams. (a) Body seams welded.

6. Parts and dimensions. (a) Parts and dimensions as follows:

Marked capacity not over (gallons)	Type of container	Minimum thickness uncoated sheets (gauge)		Rolling hoops		
		Body sheet	Head sheet	Type	Minimum Size (gauge or inch)	Minimum Weight (pounds per foot)
[illegible]	Straight side ..	24	24	None.....	.....	.....
[illegible]	do	20	20	.. do	.....	.....
[illegible]	.. do	18	18	(1)	.....	.....
[illegible]	.. do	16	16	(1) (2)	.....	.....

(1) Rolled or swedged in hoops.

(2) Each removable head drum body must have three rolled or swedged in hoops with the centre-line of one not more than 3 inches from the top curl.

(b) Steel sheets of specified gauges shall comply with the following:

Gauge No.	Nominal thickness[1] (inch)	Minimum thickness[1] (inch)
[illegible]	0.0598	0.0533
[illegible]	0.0478	0.0428
[illegible]	0.0359	0.0324
[illegible]	0.0239	0.0209

[1]Thickness shall be measured at any point on the sheet not less than 3/8 inch from an edge.

7. Convex heads. (a) Convex (crowned) heads, not extending beyond level of chime, required for drums of 21 gallons capacity or over; minimum convexity of 3/8 inch required.

8. Closures. (a) Adequate to prevent leakage; gaskets required.

(b) Closing part (plug, cap, plate, etc., see Note 1) must be of metal as thick as prescribed for head of container; this not required for containers of 10 gallons or less when the opening to be closed is not over 2.7 inches in diameter. If unthreaded cap is used it must be provided with outside sealing devices which cannot be removed without destroying the cap or sealing device.

NOTE 1: This does not apply to cap seal over a closure which complies with all requirements.

(c) For closure with threaded plug or cap, the seat (flange, etc.) for plug, or cap, must have 3 or more complete threads; two drainage holes of not over 5/16 inch diameter are allowed. Plug, or cap, must have sufficient length of thread to engage 3 threads when screwed home with gasket in place. Threaded closures having fewer threads are authorized for containers having a capacity of 10 gallons or less when such closures are approved by the Commission or Bureau of Explosives upon proof of satisfactory tests.

(1) Closures of screw-thread type or closed by other positive means, of any material or design, may be authorized by the Commission or The Bureau of Explosives for use, upon satisfactory proof of efficiency.

(d) Full removable head drums over 5 gallons capacity must be closed by means of 12 gauge bolted ring with drop forged lugs, one of which is threaded, and having 3/8 inch bolt and nut for drums not over 25 gallons capacity and 5/8 inch bolt and nut for drums over 25 gallons capacity. Five gallon drums must be of lug type closure with cover having at least 16 lugs. Equally efficient types of closures are authorized upon demonstration and proof of satisfactory tests to representative of the Commission or the Bureau of Explosives.

9. Defective containers. (a) Leaks and other defects to be repaired by method used in constucting container, not by soldering.

10. Marking. (a) Marking on each container by embossing on head, except that such embossment must be on the permanent head for drums having removable heads, with raised marks, or by embossing or die stamping on footring on drums equipped with footrings, or on metal plates securely attached to drum by brazing or welding not less than 20 per cent of the perimeter, as follows:

(1) CTC-17C. The letters STC; located near the CTC mark to indicate "single-trip container". In addition, when the container is of stainless steel, the type of steel used in body and head sheets as identified by American Iron and Steel Institute type number, and also the letters HT following steel designation on containers subjected to stress-relieving or heat-treatment during manufacture (for example, CTC-17C—304 or CTC-17C—304 HT as applicable) shall be shown. These marks shall be understood to certify that the container complies with all specification requirements.

(2) Name or symbol (letters) of maker; this must be recorded with the Bureau of Explosives through the Canadian Transport Commission.

(3) Gauge of metal in thinnest part, rated capacity in gallons, and year of manufacture (for example, 14-46-50). When gauge of metal in body differs from that in head, both must be indicated with slanting line between and with gauge of body indicated first (for example, 14/12-46-50 for body 14 gauge and head 12 gauge).

11. Size of markings. (a) Size of markings (minimum): 1/2" high for 27 1/2-gallons or less, 3/4" for over 27 1/2 and not over 46 gallons.

12. Type tests. (a) Samples taken at random and closed as for use, shall withstand prescribed tests without leakage. Tests to be made of each type and size by each company starting production and to be repeated every four months. Samples last tested to be retained until further tests are made or for one year, whichever period is shorter.

(1) Test by dropping, filled with water to 98 per cent capacity, from height of 4 feet on to solid concrete so as to strike diagonally on chime, or when without chime seam, to strike on other circumferential seam; also additional drop test on any other parts which might be considered weaker than the chime. Closing devices and other parts projecting beyond chime or rolling hoops must also be capable of withstanding this test.

(a)(2) Hydrostatic pressure test of 40 pounds per square inch sustained for 5 minutes; except that full removable head drums must sustain 20 pounds per square inch.

13. Leakage test. (a) Each container shall be tested, with seams under water or covered with soap suds or heavy oil, by interior air pressure of at least 15 pounds per square inch. Equally efficient means of testing are authorized upon demonstration and proof of satisfactory tests to representatives of the Commission or Bureau of Explosives. Leakers shall be rejected or repaired and retested. Removable head containers not required to be tested with heads in place except that samples taken at random and closed as for use, of each type and size, must be tested at start of production and repeated every four months. Samples so tested must be retained until further tests are made or for one year, whichever period is shorter.

Specification 17E

STEEL DRUMS

Single-trip container. Removable head containers not authorized.

1. Compliance. (a) Required in all details.

2. Rated Capacity. (a) Rated capacity as marked, see para. 10(a)(3). Minimum actual capacity of containers shall be not less than rated (marked) capacity plus 3.6 per cent. Maximum actual capacity shall not be greater than rated (marked) capacity plus 4.6 per cent or rated (marked) capacity plus 4 per cent plus 1 quart whichever is the greater.

3. Composition. (a) Sheets for body and heads to be low carbon, open-hearth or electric steel.

5. Seams. (a) Body seams welded.

6. Parts and dimensions. (a) Parts and dimensions as follows:

Marked capacity not over (gallons)	Type of container	Minimum thickness uncoated sheets (gauge)		Rolling hoops		
		Body sheet	Head sheet	Type	Minimum Size (gauge or inch)	Minimum Weight (pounds per foot)
5	Straight side	24	24	None		
8 1 2	do	22	22	do		
25	do	[2]19	[2]19			
46	do	[2]18	18			

[1] Rolled or swedged-in hoops.
[2] 20 gauge authorized.

(b) Steel sheets of specified gauges shall comply with the following:

Gauge No.	Nominal thickness[1] (inch)	Minimum thickness[1] (inch)
18	0.0478	0.0428
19	0.0418	0.0378
20	0.0359	0.0324
22	0.0299	0.0269
24	0.0239	0.0209

[1] Thickness shall be measured at any point on the sheet not less than 3 8 inch from an edge.

7. Convex heads. (a) Convex (crowned) heads, not extending beyond level of chime, required for drums of 21 gallons capacity or over. Convexity to be minimum of 3/8".

8. Closures. (a) Adequate to prevent leakage; gaskets required.

(b) Closing part (plug, cap, plate, etc., see Note 1) must be of metal as thick as prescribed for head of container: Provided, That thinner metal closures or closures of other material are authorized for containers of 10 gallons capacity or less when opening to be closed is not over 2.7 inches in diameter and closures, except threaded metal closures, are fitted with outside sealing devices which cannot be removed without destroying the closure or sealing device. (See para.(d) of this section.)

NOTE 1: This does not apply to cap seal over a closure which complies with all requirements.

(c) For closure with threaded plug or cap, the seat (flange, etc.) for plug, or cap, must have 3 or more complete threads; two drainage holes of not over 5/16 inch diameter are allowed. Plug, or cap, must have sufficient length of thread to engage 3 threads when screwed home with gasket in place: Provided, That for containers having a capacity of 10 gallons and less the seat (flange, etc.) for plug or cap, must have two or more complete threads and plug, or cap, must have sufficient length of thread to engage two threads when screwed home with gasket in place.

(d) Closures of screw-thread type or closed by positive means, of any material or design, may be authorized by the Commission or the Bureau of Explosives for use, upon satisfactory proof of efficiency.

9. Defective containers. (a) Leaks and other defects to be repaired by method used in constructing container, not by soldering.

10. Marking. (a) Marking on each container by embossing on head with raised marks, or by embossing or die stamping on footring on drums equipped with footrings, or on metal plates securely attached to drum by brazing or welding not less than 20 per cent of the perimeter as follows:

(1) CTC-17E. The letters STC; located near the CTC mark to indicate "single-trip container". In addition, when the container is of stainless steel, the type of steel used in body and head sheets as identified by American Iron and Steel Institute type number, and also the letters HT following steel designation on containers subjected to stress-relieving or heat-treatment during manufacture (for example, CTC-17E—304 or CTC-17E—304 HT as applicable) shall be shown. These marks shall be understood to certify

that the container complies with all specification requirements.

(2) Name or symbol (letters) of maker; this must be recorded with the Bureau of Explosives through the Canadian Transport Commission.

(3) Gauge of metal in thinnest part, rated capacity in gallons, and year of manufacture (for example, 12-46-50). When gauge of metal in body differs from that in head, both must be indicated with slanting line between and with gauge of body indicated first (for example, 14/12-46-50 for body 14 gauge and head 12 gauge).

11. Size of markings. (a) Size of markings (minimum): ½" high for 27½-gallons or less, ¾" for over 27½ and not over 46 gallons.

12. Type tests. (a) Samples taken at random closed as for use, shall withstand prescribed tests without leakage. Tests to be made of each type and size by each company starting production and to be repeated every four months. Samples last tested to be retained until further tests are made or for one year, whichever period is shorter. The type tests are as follows:

(1) Test by dropping, filled with water to 98 per cent capacity from height of 4 feet onto solid concrete so as to strike diagonally on chime, or when without chime seam, to strike on other circumferential seam; also additional drop test on any other parts which might be considered weaker than the chime. Closing devices and other parts projecting beyond chime or rolling hoops must also be capable of withstanding this test.

(2) Hydrostatic pressure test of 15 pounds per square inch sustained for 5 minutes.

13. Leakage test. (a) Each container shall be tested, with seams under water or covered with soapsuds or heavy oil, by interior air pressure of at least 7 pounds per square inch for containers over 10 gallons capacity and at least 5 pounds for others. Equally efficient means of testing are authorized upon demonstration and proof of satisfactory tests to representative of the Commission or the Bureau of Explosives. Leakers shall be rejected or repaired and retested.

Specification 17F

STEEL DRUMS

Single-trip container, Removable head containers not authorized.

1. Compliance. (a) Required in all details.

2. Rated capacity. (a) Rated capacity as marked, see para. 11(a)(3). Actual capacity of containers shall be not less than rated (marked) capacity plus 2 per cent, nor greater than rated capacity plus 2 per cent plus 1 quart, except that for containers over 25 gallons marked capacity, actual capacity shall be not less than rated capacity plus 2 per cent, nor greater than rated capacity plus 2 per cent plus 2 quarts.

3. Composition. (a) Sheets for body and heads to be low carbon, open-hearth or electric steel. Steel to be as high as practicable in tensile strength, having no loose oxide or scale.

5. Seams. (a) Body seams welded.

(b) Head and chime seams welded or double-seamed.

(c) Flanges for closures welded in place.

6. Chime reinforcement. (a) Chime reinforcement required and to be not less than 12 gauge.

7. Parts and dimensions. (a) Parts and dimensions as follows:

Marked capacity not over (gallons)	Type of container	Minimum thickness uncoated sheets (gauge)		Rolling hoops		
					Minimum	
		Body sheet	Head sheet	Type	Size	Weight
46	Straight side ..	16	16	[illegible]	.....	.....

[1] Rolled or swedged-in hoops. Use of I-bar hoops authorized.

(b) Steel sheets of specified gauges shall comply with the following:

Gauge No.	Nominal thickness[1] (inch)	Minimum thickness[1] (inch)
12	0.1046	0.0946
16	0.0598	0.0533

[1] Thickness shall be measured at any point on the sheet not less than 3/8 inch from an edge.

8. Rolling hoops and convex heads. (a) Rolling hoops to be expanded. Alternate use of I-bar hoops authorized.

(b) Convex heads. Convex (crowned) heads minimum convexity to be ⅜ inch, with minimum chime height of ⅞ inch.

9. Closures. (a) Adequate to prevent leakage; gaskets required.

(b) Closing part (plug, cap, plate, etc., see Note 1) must be of metal as thick as prescribed for head of container; this not required for containers of 10 gallons or less when the opening to be closed is not over 2.3 inches in diameter. If unthreaded cap is used it must be provided with outside sealing devices which cannot be removed without destroying the cap or sealing the device.

NOTE 1: This does not apply to cap seal over a closure which complies with all requirements.

(c) Closure must be of screw-thread type or fastened by screw-thread device.

(d) One opening not over 2.3 inches and one opening not over ¾ inch allowed; both openings to be welded in one head only. Threads to be standard pipe thread of 11 threads per inch for the larger opening and 14 threads per inch for the ¾-inch opening.

10. Defective containers. (a) Leaks and other defects to be repaired by method used in constructing container, not by soldering.

11. Marking. (a) Marking on each container by embossing on head with raised marks, or by embossing or die stamping on footring on drums equipped with footrings, or on metal plates securely attached to drum by brazing or welding not less than 20 per sent of the perimeter as follows:

(1) CTC-17F. The letters STC; located near the CTC mark to indicate "single-trip container". In addition, when the container is of stainless steel, the type of steel used in body and head sheets as identified by American Iron and Steel Institute type number, and also the letters HT following steel designation on containers subjected to stress-relieving or heat-treatment during manufacture (for example, CTC-17F—304 or CTC-17F—304 HT as applicable) shall be shown. These marks shall be understood to certify that the container complies with all specification requirements.

(2) Name or symbol (letters) of maker; this must be recorded with the Bureau of Explosives through the Canadian Transport Commission.

(3) Gauge of metal in thinnest part, rated capacity in gallons, and year of manufacture (for example, 12-46-50).

12. Size of markings. (a) Size of markings (minimum): ½" high for 27½-gallons or less, ¾" for over 27½ and not over 46 gallons.

13. Type tests. (a) Samples taken at random and closed as for use, shall withstand prescribed tests without leakage. Tests to be made of each type and size by each company starting production and to be repeated every four months. Samples last tested to be retained until further tests are made or for one year, whichever period is shorter. The type tests are as follows:

(1) Test by dropping, filled with water to 98 per cent capacity, from height of 6 feet onto solid concrete so as to strike diagonally on chime, or when without chime seam, to strike on other circumferential seam; also additional drop test on any other parts which might be considered weaker than the chime. Closing devices and other parts projecting beyond chime or rolling hoops must also be capable of withstanding this test.

(2) Hydrostatic pressure test of 80 pounds per square inch sustained for 5 minutes.

14. Leakage test. (a) Each container shall be tested, with seams under water or covered with soapsuds or heavy oil, by interior air pressure of at least 15 pounds per square inch. Equally efficient means of testing are authorized upon demonstration and proof of satisfactory tests to representative of the Commission or Bureau of Explosives. Leakers shall be rejected or repaired and retested.

Specification 17H

STEEL DRUMS

Single-trip container. Removable head required.

1. Compliance. (a) Required in all details.

2. Rated Capacity. (a) Rated capacity as marked, see para. 10(a)(3). Minimum actual capacity of containers shall be not less than rated (marked) capacity plus 3½ per cent. Maximum actual capacity shall not be greater than rated (marked) capacity plus 5 per cent or rated (marked) capacity plus 4 per cent plus 1 quart whichever is the greater.

3. Composition. (a) Sheets for body and heads to be low carbon, open-hearth or electric steel.

5. Seams. (a) Body seams welded.

6. Parts and dimensions. (a) Parts and dimensions as follows:

Marked capacity not over (gallons)	Type of container	Minimum thickness uncoated sheets (gauge)			Rolling hoops		
		Body sheet	Bottom head sheet	Removable head sheet	Type	Minimum Size (gauge or inch)	Minimum Weight (pounds per foot)
5	Straight side	24	24	20	None		
25	do	18	18	18			
46	do	18	18	14[3]			

[1] Rolled or swedged in hoops.
[2] Each drum must have three rolled or swedged in hoops, one to be placed in the body near the top curl.
[3] 16 gauge authorized provided there are one or more corrugations in the cover near the periphery.

(b) Steel sheets of specified gauges shall comply with the following:

Gauge No.	Nominal thickness[1] (inch)	Minimum thickness[1] (inch)
14	0.0747	0.0677
16	0.0598	0.0533
18	0.0478	0.0428
20	0.0359	0.0324
24	0.0239	0.0209

[1] Thickness shall be measured at any point on the sheet not less than 3/8 inch from an edge.

7. Convex heads. (a) Convex (crowned) heads, not extending beyond level of chime, required for drums of 21 gallons capacity or over; minimum convexity of ⅜ inch required.

8. Closures: (a) Adequate to prevent leakage; gaskets required.

(b) Drums over 5 gallons capacity must be closed by means of 12 gauge bolted ring with drop forged lugs, one of which is threaded, and having ⅜ inch bolt and nut for drums not over 25 gallons capacity and ⅝ inch bolt and nut for drums over 25 gallons capacity. Five gallon drums must be of lug type closure with cover having at least 16 lugs. Equally efficient types of closures are authorized upon demonstration and proof of satisfactory tests to representative of the Commission or the Bureau of Explosives.

(c) For closure with threaded plug or cap, the seat (flange etc.) for plug, or cap, must have 3 or more threads; two drainage holes of not over 5/16 inch diameter are allowed. Plug, or cap, must have sufficient length of thread to engage 3 threads when screwed home with gasket in place. Provided, that for containers having a

capacity of 10 gallons and less the seat (flange, etc.) for plug, or cap, must have two or more complete threads and plug, or cap, must have sufficient length of thread to engage two threads when screwed home with gasket in place.

(1) Closures of screw-thread type or closed by other positive means, of any material or design, may be authorized by the Commission or the Bureau of Explosives for use, upon satisfactory proof of efficiency.

9. Defective containers. (a) Leaks and other defects to be repaired by method used in constructing container, not by soldering.

10. Marking. (a) Marking on each container by embossing on head, except that such embossment must be on the permanent head for drums having removable heads, with raised marks, or by embossing or die stamping on footring on drums equipped with footrings, or on metal plates securely attached to drum by brazing or welding not less than 20 per cent of the perimeter, as follows:

(1) CTC-17H. The letters STC; located near the CTC mark to indicate "single-trip container". In addition, when the container is of stainless steel, the type of steel used in body and head sheets as identified by American Iron and Steel Institute type number, and also the letters HT following steel designation on containers subjected to stress-relieving or heat-treatment during manufacture (for example, CTC-17H—304 or CTC-17H—304 HT as applicable) shall be shown. These marks shall be understood to certify that the container complies with all specification requirements.

(2) Name or symbol (letters) of maker; this must be recorded with the Bureau of Explosives through the Canadian Transport Commission.

(3) Gauge of metal in thinnest part, rated capacity in gallons, and year of manufacture (for example, 12-46-50). When gauge of metal in body differs from that in head, both must be indicated with slanting line between and with gauge of body indicated first (for example-14/12-46-50 for body 14 gauge and head 12 gauge).

11. Size of markings. (a) Size of markings (minimum): ½" high for 27½-gallons or less, ¾" for 27½ and not over 46 gallons.

12. Type tests. (a) Samples taken at random and closed as for use, shall withstand prescribed tests without leakage. Tests to be made of each type and size by each company starting production and to be repeated every four months. Samples last tested to be retained until further tests are made or for one year, whichever period is shorter. The type tests are as follows:

(1) Test by dropping, filled with water to 98 per cent capacity, from height of 4 feet on to solid concrete so as to strike diagonally on chime, or when without chime seam, to strike on other circumferential seam; also additional drop test on any other parts which might be considered weaker than the chime. Closing devices and other parts projecting beyond chime or rolling hoops must also be capable of withstanding this test.

(2) Hydrostatic pressure test of 15 pounds per square inch sustained for 5 minutes.

13. Leakage test. (a) Each container shall be tested, with seams under water or covered with soapsuds or heavy oil, by interior air pressure of at least 7 pounds per square inch for containers over 10 gallons capacity and at least 5 pounds for others. Equally efficient means of testing are authorized upon demonstration and proof of satisfactory tests to representative of the Commission or the Bureau of Explosives. Leakers shall be rejected or repaired and retested. Containers not required to be tested with heads in place except that samples taken at random and closed as for use, of each type and size, must be tested at start of production and repeated every four months. Samples so tested must be retained until further tests are made.

Specification 18B
WOODEN KITS

1. Compliance. (a) Required in all details.

2. Tops and bottoms. (a) Pieces to be glued together.

3. Parts required and dimensions. (a) Parts required and dimensions as follows:

Authorized gross weight (pounds)	Thickness (minimum)		Hoops (minimum)		
	Top and bottom (inch)	Staves (inch)	Number	Width (inch)	Gauge
25	1 2	3 4	3	9/16	23
40	1 2	1 2	3	5/8	23

[1] Birmingham wire gauge (number).

4. Middle hoop. (a) Middle hoop of No. 11 gauge wire authorized.

5. Type test. (a) Sample, filled with dry, finely powdered material to authorized gross weight and closed as for use, shall withstand, without leaking, a drop from height of 4 feet on to solid concrete so as to strike diagonally on top chime.

6. Marking. (a) Marking on each container plainly as follows:

(1) CTC-18B, followed by the authorized gross weight (for example, CTC-18B25). This mark shall be understood to certify that the container complies with all specification requirements.

(2) Name or symbol (letters) of maker; this must be registered with the Bureau of Explosives through the Commission, and located just above, below, or following the mark specified in paragraph (a) (1) of this section.

7. Size of mark. (a) Size of mark (minimum): ½" high

Specification 19A

WOODEN BOXES—GLUED PLYWOOD CLEATED

1. Compliance. (a) Required in all details.

2. Three-way corners. (a) Three-way corners (when specified in secs. 3 to 13) shall be of type so nailing will be into edge grain of cleats, unless otherwise specified.

3. Lumber. (a) Well seasoned and commercially dry; free from decay, loose knots, knots that would interfere with nailing, and other defects that would materially lessen the strength. Cleats to be free from knots and grain of wood must not cross cleat in less than one-half its length.

(b) To be at least 3-ply, except for cleats; each ply glued in place with grain at right angles to the one next.

4. Nails. (a) Cement coated and of size specified for "sinkers", "coolers", and "3-ply-veneer nails" as generally known to the trade.

5. Grouping of principal woods. (a) Grouping as follows:

Group 1

White pine	Chestnut	White fir
Norway pine	Sugar pine	Cedar
Aspen (popple)	Cypress	Redwood
Spruce	Basswood	Butternut
Western (yellow) pine	Willow	Cucumber
Cottonwood	Noble fir	Alpine fir
Poplar	Magnolia	Lodgepole pine
Balsam fir	Buckeye	Jack pine
Red alder	Green ash	Red pine
Manitoba maple	Pine ponderosa	

Group 2

Southern yellow pine	North Carolina pine	Larch (tamarack)
Hemlock	Douglas fir	

Group 3

White elm	Pumpkin ash	Tupelo
Red gum	Black ash	Maple—soft or silver
Sycamore	Black gum	

Group 4

Hard maple	Hackberry	White ash
Beech	Birch	Hickory
Oak	Rock elm	

6. Three-way corners. (a) Three-way corners required; except for authorized gross weight not over 75 pounds.

7. Cleats required. (a) Two on each face at opposite edges; others as necessary so that cleats are not over 12″ apart. These to extend full length of face.

(b) Others, if necessary, to provide nailing surface at each box edge.

8. Parts and dimensions. (a) Parts and dimensions as follows:

Authorized gross weight	Plywood minimum thickness[1]	Cleats of group 1 or 2 woods[1]		Cleats of group 3 or 4 woods[1]	
		Minimum thickness	Minimum width	Minimum thickness	Minimum width
Pounds	Inch	Inch	Inches	Inch	Inches
50	3/20	½	1 ½	½	1½
75	3/20	9/16	1 11/16	½	1½
100	3/16	⅝	1 ⅞	½	1½
150	3/16	11/16	2 1/16	½	1½
200	3/12	¾	2 ¼	9/16	1 11/16
300	3/12	13/16	2 7/16	⅝	1⅞
400	3/12	⅞	2 ⅝	11/16	2 1/16

[1] Variation authorized of ⅛ prescribed thickness of any part not to exceed 10 per cent of its area. Cleats at least ½″ thick of cross section equivalent to prescribed cleats are authorized.

9. Marking. (a) Marking on each container with letters and figures at least ½″ high in rectangle as follows:

CTC-19A***

(1) The stars must be replaced by authorized gross weight (for example, CTC-19A200) This mark shall be understood to certify that box complies with all specification requirements.

(2) Name of maker located just above, below, or following the mark specified in paragraph (a) of this section; symbol (letters) authorized if registered with the Bureau of Explosives through the Commission.

10. Setting up and closing all boxes. (a) Each edge of each plywood section secured with 3-ply-veneer cement coated nails, or staples, at 3″ intervals as follows:

(1) To face of cleat; clinching required; cement coating optional.

(2) To edge of cleat; except when nailing through a cleat in which case nail as in para. 13.

11. Boxes with 3-way corners. (a) Each cleat forming 3-way corner to be nailed with 2 nails at each end into edge of adjoining cleat.

12. Boxes without 3-way corners. (a) Each edge cleat to be nailed to cleat on adjoining face.

13. Nails and nailing under para. 11 and 12. (a) To be cement coated and as follows:

Cleats thickness inch	Nails—cement coated			
	Group 1 or 2 woods		Group 3 or 4 woods	
	Size (inch)	Spacing (inches)	Size (inch)	Spacing (inches)
½	1¾	1¾	1½	1½
9/16	2	2	1¾	1¾
⅝	2	2	1¾	1¾
11/16	2¼	2¼	2	2
¾	2¼	2¼	2	2
13/16	2½	2½	2¼	2¼
⅞	2¾	2¾	2½	2½

Specification 19B

WOODEN BOXES, GLUED PLYWOOD, NAILED

1. Compliance. (a) Required in all details.

2. Authorized gross weight. (a) Authorized gross weight not to exceed 150 pounds.

3. Plywood. (a) Plywood shall be made from veneer which has been rotary cut, sliced or sawed. It shall be well seasoned and commercially dry; free from decay, objectionable knots, that interfere with nailing, splits, gaps, and other defects that materially lessen the strength. Plywood shall be of good commercial box or sheathing grade.

(b) Plywood shall be at least 5 ply; each ply alternately glued with the grain at right angles to the one next.

4. Nails. (a) Cement coated and of size specified for "sinkers" or "coolers" as generally known to the trade.

(b) Nail spacing as follows:

Nail (size) in inches	Maximum spacing when driven into end and corner posts	
	Side grain	End grains
	Inches	Inches
1¼-inch	1¼	1
1½-inch	1½	1¼
1¾-inch	1¾	1½
2-inch	2	1¾
2¼-inch	2¼	2
2½-inch	2½	2¼
2¾-inch	2¾	2½
3-inch	3	2½

5. Corner construction. (a) Boxes exceeding 35 pounds gross weight must have 4 vertical corner posts, or other equally suitable devices or fasteners; nailed lap-joint permitted for others.

6. Assembly. (a) Assemble with grain of outer plywood face in the direction of the longest faces of the box and securely nail or fasten to corner posts or ends as provided in para. 4 and 5.

7. Special tests. (a) Samples of each type and size manufactured, taken at random, and filled with dummy contents the shape and size of expected contents, or with sand or sawdust, to the gross weight at which container is marked, closed as for use, must be capable of withstanding the following tests without serious rupture or exposure of contents:

(1) 8 drops from height of 1 foot, one on each corner, onto solid concrete.

8. Closing for shipment. (a) Box to be securely closed. Nails, if used, must be as prescribed in para. 4; hinges and hasps or other equally efficient device authorized.

9. Marking. (a) Marking on each container with letters and figures at least ½" high in rectangle as follows:

CTC-19***

(1) The stars must be replaced by authorized gross weight (for example CTC-19B150). This mark shall be understood to certify that box complies with all specification requirements.

(2) Name of maker located just above, below, or following the mark specified in para. (a) of this section; symbol (letters) authorized if registered with the Bureau of Explosives through the Commission.

Specification 21C

FIBRE DRUMS.

1. Construction requirements. (a) Parts and dimensions as follows:

(1) Drums for dry products; minimum requirements unless otherwise stated:

Net weight of contents (pounds) (not over)	Capacity maximum (gallons) (not over)	Diameter, inside, maximum (inches)	Tops and bottoms					
				Fibre[2]		Steel	Wood (thickness, inches)	
			Sidewall strength (pounds)[1,2]	Thickness (inches)	Strength[1]	(U.S. gauge)	Solid[4,5,6]	Plywood, at least 3-ply construction
60	5	11¼	500	.090	600	28	13/16	3/11
60	17	18½	600	.120	800	28	13/16	3/10
115	17	18½	700	.120	800	26	13/16	
115	46	23	800	.160	1100	26	13/16	7/16
250	46	23	900	.200	1200	24	13/16	7/16
400	62	23	1000	.220	1300	24	13/16	7/16

[1] Mullen or Cady Test. Either of the following test methods may be used. When more than single ply, test shall be determined from the summation of the tests of individual plies; or, when test is made on a complete drum, the punctures shall be made from the exterior to the interior surface, in which case the values for sidewall shall be not less than 80 per cent of the value in the above table and the values for fibre tops and bottoms shall be not less than the value in the above table. There shall be a minimum of six tests and the average shall be not less than the prescribed minimum requirements.

[2] Sidewalls. Sidewalls to be convolutely wound of fibreboard at least .012 inch thick, the plies being accured together with adhesives; or may consist of an outer shell and an inner tube each convolutely wound with each fibreboard ply not less than .012 inch thick and secured together with adhesive. Drums may contain barrier or lining materials.

[3] When made of 2 or more discs, the discs must be fastened together with adhesive.

[4] Joints in head must be Linderman joints, glued, except as specified in Footnote 5.

[5] Wooden heads at least one-half inch thick having kraft paper glued on both sides at all contact areas with water-resistant adhesive are authorized provided tests prescribed in para. 2 are successful. Joints of any type are authorized.

[6] Minimum thickness may be reduced to 25/32 inch for lumber dressed two sides.

2. Type tests. (a) Conditioning: Prior to testing, drums shall be conditioned at 50 per cent relative humidity plus or minus 2 per cent and 75°F. plus or minus 3°F. for at least 48 hours.

(b) Drop tests: Samples taken at random filled with dry finely powdered material to authorized net weight and closed as for use must withstand the following four-foot drop tests on the part specified without leakage or serious rupture. No single drum shall be subjected to more than one of the following tests. Drums with wood heads shall be dropped with grain of wood in cover parallel to concrete surface.

(1) Top chime, diagonally onto solid concrete.

(2) Bottom chime, diagonally onto solid concrete.

(3) Sidewall, over a 2-inch × 6-inch timber resting on solid concrete with 6-inch leg vertical; drop to be made with drum in horizontal position at right angles to the timber.

(4) The closure or on any other part which may be considered weaker onto solid concrete.

(c) Compression test: An empty drum shall withstand either of the following compression tests, in accordance with the following table, without buckling of the sidewalls sufficient to cause damage to its expected contents; but in no case shall the maximum deflection be more than one inch.

Maximum net weight	Maximum capacity (gallons)	Maximum inside diameter (inches)	Compression (pounds)	
			Static[1]	Dynamic[2]
60	5	11¼	1200	1600
60	20	18½	1200	1600
115	20	18½	1200	1600
115	55	23	1500	2000
250	55	23	1800	2400
400	75	23	2100	2800

[1]Static Test: Compression as specified must be applied to full area of top cover of drum for period of 48 hours.

[2]Dynamic Test: Compression as specified must be applied end to end. Speed of compression tester to be one-half inch plus or minus one-fourth inch per minute.

(e) The tests described above must be made by any company starting production, for each plant location of manufacture, on samples taken at random of each type and diameter of container and must be repeated every four months or less during production. Samples last tested must be retained until further tests are made. The tests and procedure described may be conducted at one central laboratory when testing facilities are not available at all plants, in which case the Commission shall be advised of the location where the tests are conducted.

3. Registration of drum specification. (a) Specification for each type of drum manufactured (under this specification) shall be filed with the Bureau of Explosives through the Commission. Changes in construction (drum and closure) differing from specification thus filed must be approved by the Commission before authorized for use.

4. Marking. (a) On each container as follows:

(1) Drums must be marked CTC-21C followed by the authorized net weight to which drum was constructed, for example, CTC21C115.

(2) Marks specified in subparagraph (a)(1) of this section shall be understood to certify that the fibre drum complies with all specification requirements.

(3) Name or symbol (letters) of maker; this must be registered with the Bureau of Explosives through the Commission, and be located just above, below, or following the mark specified in subparagraph (a)(1) of this section.

Specification 21P

FIBRE DRUM OVERPACK FOR INSIDE PLASTIC CONTAINER

1. Compliance. (a) Required in all details.

2. Construction requirements. (a) Fibre drum overpack for inside plastic containers as prescribed in Part 73. Fit of fibre drum overpack shall provide support for inside plastic container in such manner as to avoid wrinkling, buckling, or suspension of inside plastic container by any closure protruding through top head.

(b) Fibre sidewalls shall consist of one or more multiple-ply shells or tubes, convolutely wound of fibreboard at least 0.012 inch thickness with plies of each component secured together with adhesive; steel parts used shall be of low carbon, open-hearth, or electric steels; drum overpack shall be of tight-head or full removable cover type, straight sided, with top and bottom heading secured to sidewall by an efficient means in accordance with the following detailed minimum requirements.

Marked rated capacity of inside plastic container not over (gallons)	Authorized maximum net weight of liquid contents not over (pounds)	Fibre drum overpack parts[5,6]								
		Side-wall	Top heads and bottom heads							
			All fibre[3]		All steel		Combination fibre-steel bottoms			
							Fibre component		Steel component	
		Strength (pounds)	Thickness (inch)	Strength[2] (pounds)	Gauge	Thickness[4] (inch)	Thickness (inch)	Strength[2] (pounds)	Gauge	Thickness[4] (inch)
6 1 2	105	600	0.120	800	28	0.0129	.....	.....	.....	.....
15	245	700	0.160	1100	26	0.0159	0.090	600	28	0.0129
30	350	900	0.200	1200	24	0.0209	0.120	800	26	0.0159
30	450	1000	0.220	1300	24	0.0209	0.160	1100	26	0.0159
55	600	1200	0.240	1500	24	0.0209	0.160	1100	26	0.0159

[1] For capacity tolerances refer to applicable specifications of inside plastic containers.

[2] Mullen or Cady test. Either of the following test methods may be used. When more than single ply, test shall be determined from the summation of the tests of individual plies; or when test is made on a complete drum, the punctures shall be made from the exterior to the interior surface, in which case the values for sidewall shall be not less than 80 per cent of the value in the above table and the values for fibre tops and bottoms shall be not less than the value in the above table. There shall be a minimum of six tests and the average shall be not less than the prescribed minimum requirements.

[3] When made of 2 or more discs, the discs must be bonded together with adhesive.

[4] Thickness shall be measured at any point on the steel part not less than ⅜ inch from an edge.

[5] Two holes not exceeding ¼ inch each are permitted diametrically opposite each other in the overpack body and three holes not exceeding 3/16 inch in diameter on centres 120 degrees apart in the bottom head. Top head may have not more than two holes of suitable size to provide for protruding closures. Closures shall not protrude above plane of top chime.

[6] Overpack interior shall be free of projections, burrs, or any edges that might cause damage to inside plastic container.

3. Marking. (a) Maker of overpack and assembler of the composite container shall place a marking on side of container by printing, lithography or stamping with weather resistant ink in letters not less than ½ inch high as follows:

(1) Marking by maker of overpack.

(i) CTC-21P***; stars to be replaced by the authorized net weight for liquid products for which drum was constructed, for example, CTC-2P/450. These marks

shall be understood to certify that the fibre drum complies with all construction requirements of this specification.

(ii) Name or symbol of maker must be registered with the Bureau of Explosives and be located just above, below or following the mark specified in subparagraph (a)(1)(i) of this section.

(2) Marking by assembler of composite container.

(i) Maker or other party assuming responsibility for compliance with specification requirements shall add a marking to the overpack maker's marking as specified by subparagraph (a)(1)(i) of this section identifying the inside plastic container specification number. For example, CTC-21P/450/2SL. "STC" shall be added to the marking when inside container is authorized only for single trip service. For example, CTC-21P/450/2U STC.

(ii) The name or symbol of the assembler to be located near the marking specified in subparagraph (a)(2)(i) of this section; symbol must be registered with the Bureau of Explosives.

4. Compression test. (a) Prior to testing, drums shall be conditioned at 50 per cent plus or minus 2 per cent relative humidity and 75°F. plus or minus 3°F. for at least 48 hours.

(b) An empty fibre drum overpack shall withstand either of the following compression tests without buckling of the sidewall sufficient to cause damage, but in no case shall the maximum top to bottom deflection be more than ½ inch:

Fibre drum overpack for plastic inside container of marked (rated) capacity	Compression	
Not over (gallons)	Static[1] (pounds)	Dynamic[2] (pounds)
13	1125	1500
25	1800	2400
46	2400	3200

[1] Static test. Compression as specified must be applied to entire bearing surface of top of drum for a period of 48 hours.
[2] Dynamic test. Compression as specified must be applied end to end. Speed of compression tester to be 1 2 inch plus or minus 1/4 inch per minute.

(c) Test to be made at start of production and repeated at 4-month intervals for each size of each type drum overpack manufactured. Record of test results shall be maintained in current status by each manufacturer at each producing plant.

5. Assembly and testing of composite container. (a) The method employed for assembly shall be such as not to cause damage to either component.

(b) The party doing assembly shall be responsible for compliance with 2(a) and for compliance with test requirements specified by applicable inside plastic container specifications.

Specification 22A

WOODEN DRUMS—GLUED PLYWOOD

1. Compliance. (a) Required in all details.

2. Lumber. (a) To be well seasoned, commercially dry, and free from decay, loose knots, knots that would interfere with nailing, and other defects that would materially lessen the strength.

3. Woods required for plywood. (a) As follows:

Group 3

White elm	Pumpkin ash	Tupelo
Red gum	Black ash	Maple—soft or silver
Sycamore	Black gum	

Group 4

Hard maple	Hackberry	White ash
Beech	Birch	Hickory
Oak	Rock elm	

4. Plywood. (a) At least 2-ply for body and 3-ply for heads; all plies glued together cross grain.

5. Hoops and battens. (a) Grain of wood must not cross piece within ½ of its length. Hoops to be of elm.

Exception: Plywood hoops 0.28″ thick are authorized.

6. Parts and dimensions. (a) Parts and dimensions as follows:

Maximum net weights authorized	Thickness (minimum)		Size of hoops (minimum)		Head liners (minimum)
	Body	Heads	Wooden	Metal[4]	
Pounds	Inch	Inch	Inch	Inch	Inch
33	0.16	3/8	1/2 x 2	0.023 x 1 7/16 or .015 x 2 3 8	1/8 x 5/8
56	.18	3/8	1/6 x 2	.023 x 17/16 or .015 x 2 3 8	1/8 x 5/8
115	.20	3/8	1/6 x 2 1/4	.023 x 19/10 or .015 x 2 3 8	1/4 x 3/4
200	.28	0.43	1/4 x 3	.028 x 19/16	1/4 x 3/4

[3] Authorized only when metal hoop is between body of drum and wooden hoop as described in Sec. 8.
[4] On drums of not over 9 gallons capacity having authorized maximum net weights not over 115 pounds, additional outside head liners may be used in lieu of metal hoops provided containers will pass prescribed tests. (See Sec. 14.)

7. Body joints. (a) To be made by steel strip 0.015″ × 1½″ secured by staples, clinched, at 1⅛″ centres, or by other method giving equivalent strength; also to be made siftproof by 2 thicknesses of 3″ paper tape 60-pound strength, Mullen or Cady test, or other equivalent protection.

NOTE 1: Until further order of the Commission, tape 2½″ may be used.

8. Hoops. (a) One wooden and 1 metal required at each chime; wooden hoops secured by staples, clinched, at 3″ centres; metal hoops to be outside wooden hoops and secured by punching, or other equivalent method, at 6″ centres.

9. Head battens. (a) Required for heads over 15″ diameter; ¾″ × 3″, minimum; ends rounded to fit chime.

10. Head liners. (a) Required inside and outside for full circumference of heads. To be securely fastened by staples or nails, clinched.

11. Head lining paper. (a) Required for each head; 1½″ larger than head diameter; of No. 1 Kraft paper 90 pounds per ream (480 sheets 24″ × 36″) or equivalent.

NOTE 1: Until further order of the Commission, a ream may consist of 500 sheets.

12. Bung openings. (a) Bung and bunghole authorized, provided head lining paper is glued around hole.

13. Insertion of head. (a) As in para. 16.

14. Tests. (a) Samples of each type and size taken at random, filled with dry, fine powder to the authorized net weight and closed as for use, must be capable of withstanding, without leakage, 2 drops diagonally on either end chime on to solid concrete from height of 4 feet.

15. Marking. (a) Marking on each container by marks ¾″ high, as follows:

(1) CTC-22A, followed by authorized gross weight (authorized net weight plus approximate tare weight, for example, CTC-22A115). This mark shall be understood to certify that the container complies with all specification requirements.

(2) Name or symbol (letters) of maker; this must be registered with the Bureau of Explosives through the Commission and located just above, below, or following the mark specified in paragraph (a)(1) of this section.

16. Closing for shipment—(a) Closing heads. Insert head lining paper, head, and head liner; nail with 15 gauge nails, clinched, at 2″ centres through head liner, body and wooden hoop; equivalent stapling authorized. Nail through steel hoop with two 2¼ inch nails into each end of head batten, if any.

17. Bung closures. (a) Bung closures (if any) must be well driven and secured sufficiently to prevent leakage in transit.

Specification 22B

WOODEN DRUMS—GLUED PLYWOOD

1. Compliance. (a) Required in all details.

2. Lumber. (a) To be well seasoned, commercially dry, and free from decay, loose knots, knots that would interfere with nailing, and other defects that would materially lessen the strength.

3. Woods required for plywood. (a) Woods required as follows:

Group 3

White elm	Pumpkin ash	Tupelo
Red gum	Black ash	Maple—soft or silver
Sycamore	Black gum	

Group 4

Hard maple	Hackberry	White ash
Beech	Birch	Hickory
Oak	Rock elm	

4. Plywood. (a) At least 2-ply for body and 3-ply for heads; all plies glued together cross grain.

5. Hoops and battens. (a) Grain of wood must not cross piece within ½ of its length. Hoops to be of elm. Exception; Plywood hoops 0.28″ thick are authorized.

6. Parts and dimensions. (a) Parts and dimensions as follows:

Maximum net weights authorized	Thickness (minimum)		Size of hoops (minimum)		Head liners (minimum)
	Body	Heads	Wooden	Metal[2]	
Pounds	Inch	Inch	Inch	Inch	Inch
33	0.16	3/8	1/8 x 2	0.023 x 1 7/16 [1].015 x 2 3 8	1/3 x 5/8
56	.18	3/8	1/6 x 2	.023 x 1 7 16 [2].015 x 2 3/8	1/3 x 5/8
115	.20	3/8	1/6 x 2 1/4	.028 x 1 9/16 [1].015 x 2 3 4	1/4 x 3/4
200	.28	0.43	1/4 x 3	.028 x 1 9/16	1/4 x 3/4

[1] Authorized only when metal hoop is between body of drum and wooden hoop as described in para. 8.

[2] On drums of not over 9 gallons capacity having authorized maximum net weights not over 115 pounds, additional outside head liners may be used in lieu of metal hoops provided containers will pass prescribed tests (See para. 13.).

7. Body joint. (a) Joint to be made by steel strip 0.015″ × 1½″ secured by staples, clinched, at 1⅛″ centres, or by other method giving equivalent strength.

8. Hoops. (a) One wooden and 1 metal required at each chime; wooden hoops secured by staples, clinched, at 3″ centres; metal hoops to be outside wooden hoops and secured by punching, or other equivalent method, at 6″ centres.

9. Head battens. (a) Required for heads over 15″ diameter, ¾″ × 3″, minimum; ends rounded to fit chime.

10. Head liners. (a) Required inside and outside for full circumference of heads. To be securely fastened by staples or nails, clinched. Inside head liners not required when close fitting inside metal drum or strong container is used.

11. Bung or other openings in head. (a) Bung and bung hole authorized provided head lining paper is glued around hole. Holes are permitted in heads to provide for closing devices of inside metal drums or other strong inside containers when plywood drum is so equipped.

12. Insertion of head. (a) As in para. 15.

13. Tests. (a) Samples of each type and size taken at random, filled with dry, fine powder to the authorized net weight and closed as for use, must be capable of withstanding, without leakage, 2 drops diagonally on either end chime on to solid concrete from height of 4 feet.

14. Marking. (a) Marking on each container by marks ¾″ high, as follows:

(1) CTC-22B, followed by authorized gross weight (authorized net weight plus approximate tare weight, for example, CTC-22B235). This mark shall be understood to certify that the container complies with all specification requirements.

(2) Name or symbol (letters) of maker; this must be registered with the Bureau of Explosives through the Commis-

sion and located just above, below, or following the mark specified in paragraph (a)(1) of this section.

15. Closing for shipment. (a) Closing heads. Insert head lining paper, head, and head liner; nail with 15 gauge nails, clinched, at 2″ centres through head liner, body and wooden hoop; equivalent stapling authorized. Nail through steel hoop with two 2¼ inch nails into each end of head batten, if any.

16. Bung closures. (a) Bung closures (if any) must be well driven and secured sufficiently to prevent leakage in transit.

Specification 22C
PLYWOOD DRUM

For plastic inside container.

1. Material requirements. (a) Plywood shall be as follows:

(1) Plywood for body and heads shall be of good commercial or sheathing grade hardwood veneer. Veneer plies shall be firmly glued together with waterproof glue. A section of plywood from any part when immersed in water at room temperature for 48 hours shall show no delamination or separation of plies to qualify glue as waterproof.

(2) Plywood shall be well seasoned, commercially dry, and free from decay, loose knots that interfere with assembly, and other defects that would materially lessen the strength.

2. Construction requirements. (a) Plywood drum shall completely and snugly enclose body of inside container, or shall completely and snugly enclose body and neck of inside container. Top head of drum may have a hole of suitable size to provide for protruding neck of plastic container; bottom head may have drainage holes of suitable size. The following are required:

(1) Body shall be constructed of 2 shells, (see Note 1), butt-jointed, telescoped one within the other; outer shell shall be fastened on the outside with wire staples of not less than 17-gauge metal driven through a metal strip not less than 28-gauge by 1½ inches width and each side of body joint. Staples shall be spaced not more than 1½ inches apart and clinched on the inside. The grain of outside ply shall be paralleled and the grain of inner ply shall be vertical to plane of the heads.

NOTE 1: Each shell shall be of two-ply construction having minimum wall thickness of 1/6 inch for inside container not over 5½ gallons marked capacity and 1/11 inch for inside container not over 11⅓ gallons marked capacity.

(2) Body heads shall be of at least three-ply construction with grain of alternate plies at right angles, circled to fit snug within the body shell. Each head shall have a minimum thickness of ⅜ inch for inside container not over 5½ gallons marked capacity and 7/16 inch for inside container not over 11½ gallons marked capacity. As an alternate, ½ inch thick pine bottom heads are authorized.

(3) Hoops shall be of at least three-ply construction with grain of alternate plies at right angles. Hoops shall be fastened to body shell so that ends butt or slightly gap by driving wire staples of at least 17-gauge metal through hoop and body and be clinched on the inside; staples spaced on not less than 3 inch centers. Each hoop shall be not less than 5/16 inch thickness by 2½ inches width or inside container not over 5½ gallons marked capacity, and not less than 3/10 inch thickness by 3 inches width for inside container not over 11½ gallons marked capacity.

(4) Head retaining rings shall be of hardwood veneer not less than 1/5 inch thickness by ⅝ inch width for inside container not over 5½ gallons marked capacity, and not less than ¼ inch thickness by ¾ inch width for inside container not over 11½ gallons marked capacity. The head retaining rings shall be fastened to the body shell with wire staples clinched on the inside of not less than 17-gauge metal spaced on 3 inch centres, except that bottom ring may be fastened by 14-gauge wire staples spaced on 4 inch centres.

(b) Plywood drum for plastic inside container not over 5 gallons marked capacity shall comply with requirements of subparagraphs 1(a)(1), (2) and 2(a).

(1) Body shells shall be of two-ply construction having a minimum thickness of 2/11 inch and with grain of outside ply parallel and grain of inner ply vertical to plane of the heads. Body shall be butt-jointed and fastened on the outside with wire staples of not less than 17-gauge metal driven through a metal strip not less than 28-gauge by 1½ inches width and each side of body joint. Staples shall be spaced not more than 1½ inches apart and clinched on the inside.

(2) Body heads shall be of at least three-ply construction with grain of alternate plies at right angles circled to fit snugly within the body shell. Each head shall have a minimum thickness of ⅜ inch.

(3) Hoops shall be of hardwood veneer, not less than 2¼ inches wide by ⅛ inch thick. Hoops shall be fastened to the body by 17-gauge staples on not less than three-inch centres and shall be overlapped not less than 3 inches.

(4) Head retaining rings shall be of hardwood veneer of 1/5 inch thickness by ¾ inch width except bottom rings may be two thicknesses, each ⅛ inch thickness by 1¾ inches width. Rings shall be fastened to body shell with wire staples of 17-gauge metal on not less than 3-inch centres and clinched on inner surface.

3. Tests. (a) Samples taken at random with inner plastic container filled to marked capacity with water and closed as for use, shall be capable of withstanding prescribed tests without leakage from inside container or breakage of outside container that would be of such a nature as to contribute to potential failure of inner container. Tests shall be made of each size by each company starting production. The type test is as follows:

(1) One 4-foot drop onto solid concrete so as to strike diagonally on either chime.

(2) Additional tests as required by inside container specification.

4. Marking on outside container. (a) Each outside container must be plainly marked with letters and figures at least ¾ inch high applied by hot branding iron or dark coloured printing ink with high pressure dies as follows:

(1) CTC-22C. This mark shall be understood to certify that the complete package complies with all specification requirements.

(2) Name or symbol (letters) of company setting up the package, or other party assuming responsibility for its compliance with the specification requirements; this must be registered with the Bureau of Explosives through the Commission and located just above or below the mark specified in subparagraph (a)(1) of this section.

Specification 23F

FIBREBOARD BOXES

1. Compliance. (a) Required in all details.

2. Definitions. (a) Terms such as "200-pound test" mean minimum strength, Mullen or Cady test.

(b) "Joints" are where edges of parts of box are connected together in setting up the box. Generally done by box maker.

(c) "Seams" are where edges of parts of box are visible, except joints, when box is closed.

3. Solid fibreboard. (a) To be 3-ply or more; both outer plies waterproofed.

4. Corrugated fibreboard. (a) Both outer facings water resistant; corrugated sheets at least 0.009″ thick; all parts securely glued together throughout all contact areas; minimum combined weight of facings not less than 84 pounds per 1,000 square feet, except when only one lining tube is used as provided by para. 15(b), minimum combined weight of facings must be not less than 138 pounds per 1,000 square feet.

5. Stitching staples. (a) Stitching staples must be made in such a configuration that their holding capability as installed will not be less than that of flat steel staples 3/32 × 0.019 inch in cross section and not less than 7/16 inch wide. Material used must be at least equivalent to copper coated steel in non-sparking quality.

6. Tape. (a) Coated with glue at least equal to No. 1¾ Peter Cooper standard. Cloth tape of strength, across the woof, at least 70 units, Elmendorf test. Sisal tape of 2 sheets of No. 1 Kraft paper, total weight 80 pounds per ream (500 sheets, 24″ × 36″); sheets to be combined with asphalt and reinforced by unspun sisal fibres completely embedded in the asphalt and extending across the tape.

7. Test. (a) Acceptable board must have prescribed strength, Mullen or Cady test, under test as follows:

(1) Clamp board firmly in machine and turn wheel thereof at constant speed of approximately 2 revolutions per second.

(2) Six punctures required 3 from each side; all results but one must show prescribed strength.

(3) Board failing may be retested by making 24 punctures, 12 from each side; when all results but 4 show prescribed strength the board is acceptable.

(4) For corrugated fibreboard, double-pop tests may be disregarded.

8. Type authorized. (a) Of solid fibreboard; 1-piece, or 3-piece without recessed heads, fitted with lining tube or lining tubes as prescribed in paragraph 15, except that lining tubes are not required for boxes used for shipments of high explosives packed in accordance with § 73.63(a)(3) or electric blasting caps packed in accordance with § 73.66(g)(1) or when box is constructed of 1-piece of not less than 600-pound test board weighing not less than 300 pounds per 1,000 square feet. Boxes having handholes are authorized when approved by the Commission or the Bureau of Explosives.

9. Inside packing and size limits. (a) As prescribed in sec. 15.

10. Forming. (a) Parts must be cut true to size and so creased and slotted as to fit closely into position without cracking, surface breaks, separation of parts outside of crease, or undue binding.

11. Joints. (a) Lapped 1½″ from centre of scoreline except as in paragraph 12; stitched at 2½″ intervals and within 1″ of each end of joint; double-stitched (2 parallel stitches) at each end of joint over 18″ long; or lapped not less than 1¼″ and firmly glued throughout entire area of contact with a glue or adhesive which cannot be dissolved in water after the film application has dried.

12. Flanged heads. (a) Must have 4 flanges, at least 1″ long above fillet, on each head. Recessed flanged heads not authorized.

13. Seams which are to be stitched. (a) Overlap, if any, required to be at least 1½″ from centre of scoreline except as in paragraph 12.

14. Flap closures. (a) Flaps must butt or have full overlap excepting that inner flaps may overlap ½ inch.

15. Authorized gross weight (when packed) and parts required. (a) Box to be of solid fibreboard, special water proofed, at least 300-pound test, and weighting at least 250 pounds per thousand square feet. Tubes to be of solid or corrugated fibreboard at least 200-pound test and of 1-piece, or as provided in sub-paragraph (1), with adjoining edges stitched, taped, or glued. Glued or stitched lap not less than 1¼″. Lap must be firmly glued throughout entire area of contact with glue or adhesive which cannot be dissolved in water after the film application has dried.

(1) Or, box shall have one tube liner of solid fibreboard weighing at least 283 pounds per 1,000 square feet with joint or joints either stitched or glued as prescribed in paragraph (a). One end of the tube may have a handhole approximately ¾″ deep located at the centre of the top and a perforation with a minimum of ⅛″ cuts and ⅛″ webs extending from the handhole to the bottom.

(b) Authorized gross weight: 65 pounds when 2 or more lining tubes are used to divide the box into 2 or more compartments; 65 pounds when 1 or more lining tubes are used and contents will consist of 1 cartridge only or of black powder in bags; 65 pounds when boxes without

lining tubes are used for shipments of high explosives packaged in accordance with § 73.63(a)(3) or electric blasting caps packed in accordance with § 73.66(g)(1), 35 pounds in all other cases except that boxes having a single solid fibreboard lining tube, the fibreboard weighing at least 283 pounds per 1,000 square feet, or corrugated fibreboard lining tube as prescribed in paragraph 4(a), are authorized for 65 pounds gross weight.

16. Closing for shipment. (a) By any method capable of withstanding tests prescribed by para. 20 without failure.

17. Marking. (a) On each container. Symbol in rectangle as follows:

CTC-23F***

(1) Stars to be replaced by authorized gross weight (for example, CTC-23F35 or CTC-23F65). This mark shall be understood to certify that the container complies with all specification requirements.

(2) Name and address of plant making the container; symbol (letters) authorized if recorded with the Bureau of Explosives through the Canadian Transport Commission. This mark to be located just above or below the mark specified in paragraph (a) of this section.

(3) Size of markings: Specification markings prescribed in paragraph 17(a)(1) must be at least ½ in. high; other markings must be legible.

18. Special tests. (a) By whom and when. By or for each plant making the boxes; at beginning of manufacture and at six-month intervals thereafter; on largest size, by weight. Smaller sizes need not be tested if they have the same or equivalent construction. Report of results, with all pertinent data, to be maintained on file for one year; copy to be filed with the Bureau of Explosives and the Canadian Transport Commission.

19. Material. (a) Box material (special waterproofed board) must be 300-pound test board and weigh at least 250 pounds per thousand square feet when commercially dry.

(b) Box material must also have 200-pound test strength and moisture content not over 30 per cent as follows:

(1) Immediately after exposure for 3 days to 90 per cent humidity at 75°F.

(2) Immediately after it has been in contact with water for 3 hours under 3″ head at 75°F.

NOTE: The test shall be conducted on a sample no greater than 6 inches in diameter when exposed to water. The sample shall be rigidly fastened to a water column device so constructed as to provide at least a 3-inch head of water on the outer surface of the fibreboard sample. The water column device must be suspended in such manner that free circulation of air on the inner surface of fibreboard sample which is not exposed to water, is permitted. After contact with water for 3 hours under conditions specified, the water column device shall be emptied, the sample blotted, and immediately subjected to Mullen or Cady test. (A 6-inch diameter pipe having a welded flange to which the sample is secured by a bolted ring flange is acceptable).

20. Completed containers. (a) Samples must pass the following immediately after exposure for 2 weeks to 90 per cent humidity at 75°F.; loaded containers shall contain dummy contents of shape and weight of the expected contents, and shall be closed in same manner as for shipment:

(1) Three loaded samples to be tested. Each must withstand 200 drops in standard 7-foot revolving test drum with pointed hazard in place, without spilling any contents.

(2) Three loaded samples to be tested. Each must withstand end to end pressure of at least 500 pounds without deflection of over 1½″.

(3) Three empty samples to be tested. Each must withstand top to bottom pressure of at least 500 pounds without deflection of over ½″.

(b) As an alternate to the drum test specified in paragraph (a), 3 loaded samples must pass the drop test specified below:

(1) Box shall be dropped from height of 2 feet.

(2) Identification of face, edge, and corners. Facing one end (with the manufacturer's joint on the observer's right), the top of the box is designated as 1, the right side as 2, the bottom as 3, and the left side as 4. The near end is designated as 5 and the far end as 6. The edges are identified by the number of the two faces which make that edge, as for example, 1-2 identifies the edge where the top and right side meet and 2-5 the edge having the manufacturer's joint. The corners are identified by the number of the three faces which meet to form that corner, as for example, 1-2-5 identifies the corner where the top, the right side, and the near end meet.

(c) Drop sequence as follows:

(1) A corner drop on 1-2-5.

(2) An edge drop on the shortest edge radiating from that corner (usually 2-5).

(3) An edge drop on the next shortest edge radiating from that corner (usually 1-5).

(4) An edge drop on the longest edge radiating from that corner (usually 1-2).

(5) A flatwise drop on one of the smallest faces (usually end 5 or 6).

(6) A flatwise drop on the opposite smallest face.

(7) A flatwise drop on one of the medium faces (usually side 2 or 4).

(8) A flatwise drop on the opposite medium face.

(9) A flatwise drop on one of the largest faces (usually top 1 or bottom 3).

(10) A flatwise drop on the opposite large face.

This completes one cycle of ten drops. Commence the next cycle with a drop on the corner diagonally opposite through the box to the corner on which the first drop was made, on corner 3-4-6. Commence the third cycle of ten drops with corner 1-4-5. Each loaded container must withstand 3 cycles without spilling or sifting of contents.

Specification 23G

SPECIAL CYLINDRICAL FIBREBOARD BOX

For high explosives.

1. Compliance. (a) Required in all details.

2. Definition. (a) Terms such as "200-pound test" mean minimum strength, Mullen or Cady test.

3. Side walls, ends, and interior. (a) Side walls. To be not less than four-ply of continuous fibre sheets convolutely or spirally wound combined strength to be not less than 300 pounds, dry combined thickness to be not less than 0.050″ for containers not exceeding 10 pounds gross weight and not less than 0.060″ for containers over 10 pounds gross weight.

(b) Ends. To be of one or more plies of fibreboard sufficiently strong to withstand prescribed tests. Wax or plastic material with fibreboard inserts authorized provided the completed container will withstand the prescribed tests at temperatures from zero to 130°F.

(c) Interior of the container must be lined or so treated as to prevent penetration by the commodity with which the container is filled for shipping.

4. Stitching staples. (a) Stitching staples must be made in such a configuration that their holding capability as installed will not be less than that of flat steel staples 3/32 × 0.019 inch in cross section and not less than 7/16 inch wide. Material used must be at least equivalent to copper coated steel in non-sparking quality.

5. Tape. (a) Coated with animal glue at least equal to No. 1¾ Peter Cooper standard or other adhesive equivalent in tensile properties and resistance to deterioration. Cloth tape of strength, across the woof, at least 70 units, Elmendorf test. Sisal tape of 2 sheets of No. 1 Kraft paper, total weight 80 pounds per ream (480 sheets, 24″ × 36″); sheets to be combined with asphalt and reinforced by unspun sisal fibres completely embedded in the asphalt and extending across the tape.

6. Test of board. (a) Acceptable board must have prescribed strength, Mullen or Cady test, under test as follows:

(1) Clamp board firmly in machine and turn wheel thereof at constant speed of approximately 2 revolutions per second.

(2) Six punctures required 3 from each side; all results but one must show prescribed strength.

(3) Board failing may be retested by making 24 punctures, 12 from each side; when all results but 4 show prescribed strength the board is acceptable.

7. Type of container authorized. (a) One cylindrical tube or;

(b) Two cylindrical tubes butted together and taped or glued completely around circumference at joints to make positive closure.

(c) Open ends to be closed in such a manner as to give complete closure which will withstand prescribed tests.

8. Approval of specification required. (a) Specification for each type of container manufactured (under the specification) must be filed with and approved by the Bureau of Explosives through the Canadian Transport Commission. Changes in construction (container and closure) differing from specification thus filed must be approved before authorized for use.

9. Authorized size and weight limit. (a) Maximum authorized outside diameter of container is 12″.

(b) Maximum authorized gross weight of container is 65 pounds.

10. Marking. (a) On each container by symbol as follows:

CTC-23G***

(1) Stars to be replaced by authorized gross weight (for example, CTC-23G40, CTC-23G65, etc.) This mark shall be understood to certify that the container complies with all specification requirements.

(2) Name or symbol (letters) of maker; this must be registered with the Bureau of Explosives through the Canadian Transport Commission, and located just above, below, or following the mark specified in (a) of this section.

(3) Size of markings: Specification markings prescribed in paragraph 10(a)(1) must be at least ½ in. high; other markings must be legible.

11. Special tests. (a) By whom and when. By or for each plant making the boxes; at beginning of manufacture and at 6-month intervals thereafter; on largest size, by weight. Smaller sizes need not be tested if they have the same or equivalent construction. Report of results, with all pertinent data, to be maintained on file for one year; copy to be filed with the Bureau of Explosives and the Canadian Transport Commission.

12. Material. (a) Box material must be not less than 300 pound test board when commercially dry.

(b) Box material must also have 200-pound test strength, moisture content not over 30 per cent and puncture strength not less than 200 units, as determined by General Electric Puncture Tester using an average obtained from a series of five tests, as follows:

(c) Immediately after exposure for 3 days under either of the following conditions:

(1) 70 per cent humidity at 100°F.

(2) 90 per cent humidity at 75°F.

13. Completed containers. (a) Samples must pass the following tests immediately after exposure for 2 weeks to 90 per cent humidity at 75°F. or 70 per cent humidity at 100°F., loaded containers shall contain dummy contents of shape and weight same as expected contents.

(1) Three loaded samples to be tested. Each must withstand end to end pressure of at least 500 pounds without deflection of over 1½ inch; speed of compression tester to be ½ inch per minute plus ¼ inch minus ¼ inch per minute.

(2) Three loaded samples to be tested. Each must withstand side to side pressure of at least 500 pounds without

deflection of over ½ inch; except that for boxes with fluted crimped ends the deflection shall not exceed ¾ inch; speed of compression tester to be ½ inch per minute plus ¼ inch minus ¼ inch per minute.

(3) Three loaded samples to be tested. Each must withstand, without rupture, four 4-foot drops diagonally on the end more likely to cause rupture on impact.

(4) Three loaded samples to be tested. Each must be dropped once, flat on its side, across another similar package lying flat upon the ground with its longitudinal axis at right angles to container dropped. Drops must be made from a height four feet above the topmost point of the container on the ground.

(b) As an alternate to compression test requirements of subparagraphs (a)(1) and (a)(2) of this section, samples must pass the following tests immediately after exposure for 2 weeks to 90 per cent humidity at 75°F. or 70 per cent humidity at 100°F; loaded containers shall contain dummy contents of shape and weight same as expected contents. Static loading tests as specified herein must be conducted with the prescribed weight in place for at least 60 minutes, with deflection of container not in excess of the following:

(1) Three loaded samples to be tested. Each container must be capable of withstanding end-to-end pressure of at least 375 pounds without deflection over 1½ inches.

(2) Three loaded samples to be tested. Each container must be capable of withstanding side-to-side pressure of at least 350 pounds without deflection over ½ inch.

Specification 23H

FIBREBOARD BOXES

1. Compliance. (a) Required in all details.

2. Definitions (a) Terms such as "200-pound test" mean minimum strength, Mullen or Cady test.

(b) "Joints" are where edges of parts of box are connected together in setting up box.

(c) "Seams" are where edges of parts of box are visible, except joints, when box is closed.

3. Solid fibreboard. (a) To be 3-ply or more; both outer plies waterproofed.

4. Stitching staples. (a) Stitching staples must be made in such a configuration that their holding capability as installed will not be less than that of flat steel staples 3/32 × 0.019 inch in cross section and not less than 7/16 inch wide. Material used must be at least equivalent to copper coated steel in non-sparking quality.

5. Tape. (a) Coated with glue at least equal to No. 1¾ Peter Cooper standard. Cloth tape of strength, across the woof, at least 70 units, Elmendorf test. Sisal tape of 2 sheets of No. 1 kraft paper, total weight 80 pounds per ream (500 sheets, 24″ × 36″); sheets to be combined with asphalt and reinforced by unspun sisal fibres completely embedded in the asphalt and extending across the tape.

6. Test. (a) Acceptable board must have prescribed strength, Mullen or Cady test, under test as follows:

(1) Clamp board firmly in machine and turn wheel thereof at constant speed of approximately 2 revolutions per second.

(2) Six punctures required, 3 from each side; all results but one must show prescribed strength.

(3) Board failing may be retested by making 24 punctures, 12 from each side; when all results but 4 show prescribed strength the board is acceptable.

7. Type authorized. (a) Of solid fibreboard, telescoping type construction without recessed heads. Box to consist of top and bottom sections, divided equally or unequally, and inner lining tube or full depth cover 2-piece telescope type in which case the lining tube may be omitted. The lining tube, when required, must be staple stiched to the lower section of the box to give in effect a 2-piece box.

(b) Hand-holes oval in shape, not more than 1 inch in width by 3 inches in length and horizontal with top score line, are authorized in ends of top section of full depth cover telescope type boxes.

8. Inside packing and size limits. (a) As prescribed in sec. 11.

9. Forming. (a) Parts must be cut true to size and so creased and slotted as to fit closely into position without cracking, surface breaks, separation of parts outside of crease, or undue binding.

10. Joint. (a) Lapped at least 1½″ from centre of scoreline; staple stiched at 2½″ intervals and within 1″ of each end of joint; 2 banks of staple stiches in each joint.

11. Authorized gross weight (when packed) and parts required. (a) Box to be of solid fibreboard, special waterproofed at least 300-pound test, and weighing at least 250 pounds per thousand square feet. Tubes to be of solid fibreboard at least 200-pound test and of 1 piece with adjoining edges staple stiched or taped.

(b) Authorized gross weight: 65 pounds when 2 or more lining tubes are used to divide the box into 2 or more compartments; 65 pounds when 1 or more lining tubes are used and contents will consist of 1 cartridge only or of black powder in bags; 35 pounds in all other cases except that boxes having a single solid fibreboard lining tube, the fibreboard weighing at least 283 pounds per 1,000 square feet, are authorized for 65 pounds gross weight. Boxes of 2-piece telescope type having full depth cover are authorized for 65 pounds gross weight.

12. Closing for shipment. (a) By any method capable of withstanding tests prescribed by para. 16 without failure.

13. Marking. (a) On each container. Symbol in rectangle as follows:

CTC-23H**

(1) Stars to be replaced by authorized gross weight (for example CTC-23H35 or CTC-23H65). This mark shall be understood to certify that the container complies with all specification requirements.

(2) Name and address of plant making the container; symbol (letters) authorized if recorded with the Bureau of Explosives through Commission. This mark to be located just above or below the mark specified in paragraph (a) of this section.

(3) Size of markings: Specification markings prescribed in paragraph (a)(1) must be at least 1½ in. high; other markings must be legible.

14. Special tests. (a) By whom and when. By or for each plant making the boxes; at beginning of manufacture and at six-month intervals thereafter; on largest size, by weight. Smaller sizes need not be tested if they have the same or equivalent construction. Report of results, with all pertinent data, to be maintained on file for one year; copy to be filed with the Bureau of Explosives and the Commission.

15. Material. (a) Box material (special waterproofed board) must be 300-pound test board and weigh at least 250 pounds per thousand square feet when commercially dry.

(b) Box material must also have 200-pound test strength and moisture content not over 30 per cent as follows:

(1) Immediately after exposure for 3 days to 90 per cent humidity at 75°F.

(2) Immediately after it has been in contact with water for 3 hours under 3″ head at 75°F.

NOTE: The test shall be conducted on a sample no greater than 6 inches in diameter when exposed to water. The sample shall be rigidly fastened to a water column device so constructed as to provide at least a 3-inch head of water on the outer surface of the fibreboard sample. The water column device must be suspended in such manner that free circulation of air on the inner surface of fibreboard sample which is not exposed to water is permitted. After contact with water for 3 hours under conditions specified, the water column device shall be emptied, the sample blotted, and immediately subjected to Mullen or Cady test. (A 6-inch diameter pipe having a welded flange to which the sample is secured by a bolted ring flange is acceptable.)

16. Completed containers. (a) Samples must pass the following immediately after exposure for 2 weeks to 90 per cent humidity at 75°F.; loaded containers shall contain dummy contents of shape and weight of the expected contents, and shall be closed in same manner as for shipment.

(1) There loaded samples to be tested. Each must withstand 200 drops in stardard 7-foot revolving test drum with pointed hazard in place, without spilling any contents.

(2) Three loaded samples to be tested. Each must withstand end to end pressure of at least 500 pounds without deflection of over 1½″.

(3) Three empty samples to be tested. Each must withstand top to bottom pressure of at least 500 pounds without deflection of over ½″.

(b) As an alternate to the drum test specified in paragraph (a), 3 loaded samples must pass the drop test specified below:

(1) Box shall be dropped from height of 2 feet.

(2) Identification of face, edge, and corners. Facing one end (with manufacturer's joint on the observer's right), the top of the box is designated as 1, the right side as 2, the bottom as 3, and the left side as 4. The near end is designated as 5 and the far end as 6. The edges are identified by the number of the two faces which make that edge, as for example, 1-2 identified the edge where the top and right side meet and 2-5 the edge having the manufacturer's joint. The corners are identified by the number of the three faces which meet to form that corner, as for example, 1-2-5 identifies the corner where the top, the right side, and the near end meet.

(c) Drop sequence as follows:

(1) A corner drop on 1-2-5.

(2) An edge drop on the shortest edge radiating from that corner (usually 2-5).

(3) An edge drop on the next shortest edge radiating from that corner (usually 1-5).

(4) An edge drop on the longest edge radiating from that corner (usually 1-2).

(5) A flatwise drop on one of the smallest faces (usually end 5 or 6).

(6) A flatwise drop on the opposite smallest face.

(7) A flatwise drop on one of the medium faces (usually side 2 or 4).

(8) A flatwise drop on the opposite medium face.

(9) A flatwise drop on one of the largest faces (usually top 1 or bottom 3).

(10) A flatwise drop on the opposite large face.

This completes one cycle of ten drops. Commence the next cycle with a drop on the corner diagonally opposite through the box to the corner on which the first drop was made, on corner 3-4-6. Commence the third cycle of ten drops with corner 1-4-5. Each loaded container must withstand 3 cycles without spilling or sifting of contents.

Specification 29

MAILING TUBES

1. Compliance. (a) Required in all details.

2. Cushioning. (a) Inside containers, if any, must fit closely in tube or be properly cushioned.

3. Construction. (a) Of fibre at least ⅛″ thick; metal bottom and metal screw-cap top, or telescope type with fixed metal ends.

4. Marking. (a) On each container by letters and figures as follows: CTC-29; this mark shall be understood to certify that the container complies with all specification requirements.

Specification 32A

METAL CASES—RIVETTED OR LOCK-SEAMED

1. Compliance. (a) Required in all details.

2. Gauge standards. (a) United States standard for sheet metal; American or Brown and Sharpe for wire.

3. Covers. (a) To have at least 1″ lap on body and to fit with clearance not over 1/32″; lapped corners to be welded.

4. Edge protection. (a) Open edges of body must be turned or rolled inward: front open edge of cover must be turned or rolled outward. Not required for material at least 20-gauge thick or for "trailer" cases.

5. Bottom protection. (a) Face on which case will ordinarily rest must be reinforced with continuous angle straps, or be fitted with trunk corners, or be double thickness along edges. Not required for cases of at least 20-gauge metal or of not over 1 reel capacity or for "trailer" cases.

6. Hinges. (a) To be of continuous loop type with loops of steel wire at least 7-gauge, welded; hinge straps at least 18-gauge securely welded or rivetted.

7. Carrying handles. (a) Any type of adequate strength.

8. Closing devices. (a) To be of sufficient strength and efficiency to prevent injury or unfastening in tests (para. 14) or in transit.

9. Rivets. (a) At least 5/32″ diameter, length to furnish efficient heads; split rivets not authorized except for attachment of lining.

10. Rivet reinforcement. (a) Hinges, fastening devices, and handles, when rivetted in place, must have additional inside reinforcement of steel, at least as thick as in case, through which rivets must pass. Not required when case is made of at least 20-gauge material throughout.

11. Lining. (a) Required throughout; to be hard-surfaced fibreboard at least 0.125″ thick and with strength of 800 pounds, Mullen or Cady test, or wooden lining at least 0.25″ thick.

12. Metal partitions. (a) Metal partitions (when used) to be as thick as body of case, premanently fastened to the case, and lined the same as the case.

13. Protective coating. (a) Steel cases must be of galvanized material or protected from corrosion by paint, lacquer, or other adequate coating.

14. Type tests. (a) Cases completely filled as for shipment must be capable of withstanding 4 successive drops on to solid concrete from a height of 6 feet without rupture of case or permanent damage to or unfastening of closing device. Tests to be made by dropping on cover, seam, or any corner.

15. Marking. (a) Marking on each container by the marker with plain and permanent marks at least ½″ high as follows:

(1) CTC-32A. This mark shall be understood to certify that the container complies with all specification requirements.

(2) Name of symbol (letters) of maker; this must be registered with the Bureau of Explosives through the Commission and located just above, below, or following the mark specified in paragraph (a)(1) of this section.

16. Cases with capacity (approx.) not over 9,000 feet of 1⅜″ film. (a) Compliance with para. 1 to 15 required. Seams to be lockseams or rivetted. Material to be steel, at least 20-gauge. 2 hinges, 1 fastening device, and 1 carrying handle required.

17. Cases with capacity (approx.) not over 8,000 feet of 1⅜″ film or 4,500 feet of 2½″ film. (a) Construction as in para. 16, except: 22-gauge material authorized; 1 hinge authorized for single-reel cases.

18. Cases with capacity not over 1 reel of 10″ diameter. (a) Construction as in para. 16, except: 24-gauge material and 1 hinge authorized.

19. Cases with capacity not over 500 feet of film, "Trailer Cases". (a) Construction as in para. 16, except: 26-gauge material and 1 hinge of any type authorized.

Specification 32B

METAL CASES—WELDED OR RIVETTED

1. Compliance. (a) Required in all details.

2. Gauge standards. (a) United States standard for sheet metal; American or Brown and Sharpe for wire.

3. Covers. (a) To have at least 1″ lap on body and to fit with clearance not over 1/32″; lapped corners to be welded.

4. Edge protection. (a) Open edges of body must be turned or rolled inward; front open edge of cover must be turned or rolled outward. Not required for material at least 20-gauge thick or for "trailer" cases.

5. Bottom protection. (a) Face on which case will ordinarily rest must be reinforced with continuous angle straps, or be fitted with trunk corners, or be double thickness along edges. Not required for cases of at least 20-gauge metal or of not over 1 reel capacity or for "trailer" cases.

6. Hinges. (a) To be of continuous loop type with loops of steel wire at least 7-gauge, welded; hinge straps at least 18-gauge securely welded or rivetted.

7. Carrying handles. (a) Any type of adequate strength.

8. Closing devices. (a) To be of sufficient strength and efficiency to prevent injury or unfastening in tests (para. 14) or in transit.

9. Rivets. (a) At least 5/32″ diameter: length to furnish efficient heads; split rivets not authorized except for attachment of lining.

10. Rivet reinforcement. (a) Hinges, fastening devices, and handles, when rivetted in place, must have additional inside reinforcement of steel, at least as thick as in case, through which rivets must pass. Not required when case is made of at least 20-gauge material throughout.

11. Lining. (a) Required throughout; to be hard-surfaced fibreboard at least 0.125″ thick and with strength of 800 pounds, Mullen or Cady test, or wooden lining at least 0.25″ thick.

12. Metal partitions. (a) Metal partitions (when used) to be as thick as body of case, permanently fastened to the case, and lined the same as the case.

13. Protective coating. (a) Steel cases must be of galvanized material or protected from corrosion by paint, lacquer, or other adequate coating.

14. Type tests. (a) Cases completely filled as for shipment must be capable of withstanding 4 successive drops on to solid concrete from a height of 6 feet without rupture of case or permanent damage to or unfastening of closing device. Tests to be made by dropping on cover, seam, or any corner.

15. Marking. (a) Marking on each container by the maker with plain and permanent marks at least ½″ high as follows:

(1) CTC-32B. This mark shall be understood to certify that the container complies with all specification requirements.

(2) Name or symbol (letters) of maker; this must be registered with the Bureau of Explosives through the Commission and located just above, below, or following the mark specified in paragraph (a)(1) of this section.

16. Cases with capacity (approximate) not over 12,000 feet of 1⅜″ film or 6,000 feet of 2½″ film. (a) Compliance with para. 1 to 15 required. Seams to be welded or rivetted. Material to be steel, or aluminum-manganese alloy, at least 18-gauge. 2 hinges, 2 fastening devices spaced as for hinges, and 2 carrying handles required.

17. Cases with capacity (approximate) not over 9,000 feet of 1⅜″ film. (a) Compliance with para. 1 to 16, except: 1 fastening device and 1 carrying handle authorized.

18. Cases with capacity (approximate) not over 8,000 feet of 1⅜″ film or 4,500 feet of 2½″ film. (a) Construction as in para. 16, except: 20-gauge material, 1 fastening device, and 1 carrying handle authorized; 1 hinge authorized for single-reel cases. Detachable covers (no hinges) with ¾″ lap on body and efficiency to prevent displacement in tests, are authorized. Trailer cases, capacity not over 500 feet of film, no handle required. Cover lap not less than full one-half inch.

Specification 32C

METAL TRUNKS

1. Design. (a) To be designed to contain film in film-reel cans and projecting apparatus only; other articles not authorized therein.

2. Strength. (a) To be of strength and efficiency to carry contents in ordinary handling without damage to trunk or contents.

3. Compartments. (a) Separate compartments required for each reel of film and for projecting apparatus; each compartment to be constructed so that, in closing, it will have no cracks or openings.

4. Compartment linings. (a) Each film compartment to be made of, or lined throughout with, sheet metal; this metal to be protected against contact with film-reel can by a substantial interlining of fibreboard or equivalent.

5. Marking. (a) Marking on each container by the maker with plain and permanent marks at least ½″ high applied on 2″ by 4″ metal plate securely rivetted to top of cover of trunk as follows:

(1) CTC-32C. This mark shall be understood to certify that the container complies with all specification requirements.

(2) Name or symbol (letters) of maker; this must be registered with the Bureau of Explosives through the Commission and located just above, below, or following the mark specified in paragraph (a)(1) of this section.

Specification 32D

METAL BOXES FOR OLD AND WORN-OUT MOTION-PICTURE FILM NO LONGER EXHIBITABLE

1. Compliance. (a) Required in all details.

2. Gauge standards. (a) United States standard for sheet metal; American or Brown and Sharpe for wire.

3. Material. (a) Material to be steel; body and bottom at least 16-gauge; cover at least 18-gauge.

4. Joints and seams. (a) All joints and seams to be welded or rivetted.

5. Cover. (a) Cover must be tight-fitting, to prevent entrance of sparks, with provision for secure fastening to be locked or sealed.

6. Type tests. (a) Cases completely filled as for shipment must be capable of withstanding 4 successive drops on to solid concrete from a height of 4 feet without rupture of case or permanent damage to or unfastening of closing device. Tests to be made by dropping on cover, seam, or any corner.

7. Marking. (a) Marking on each container by the maker with plain and permanent marks at least ½″ high as follows:

(1) CTC-32D. This mark shall be understood to certify that the container complies with all specification requirements.

(2) Name or symbol (letters) of maker; this must be registered with the Bureau of Explosives through the Commission and located just above, below, or following the mark specified in paragraph (a)(1) of this section.

Specification 33A

POLYSTYRENE CASES

Nonreusable containers.

1. Material requirements. (a) Expandable polystyrene, molded to produce a completely fused closed cell composition having a minimum density of 1.25 pounds per cubic foot.

2. Design. (a) The case is to consist of two parts, a bottom section with pockets for the inside containers and a top section that covers, and interlocks with, the bottom section. Both the bottom and top sections shall be designed to provide a snug fit for the inside containers.

3. Construction. (a) The case shall be constructed in accordance with the following minimum thicknesses:

(1) Multiple bottle cases, not more than 4 individual bottles per case:

	Nominal capacity of individual inside containers	
	5 Pints	1 Gallon
Side wall and bottom, inches	3/4	1
Between inside containers, inches	5/8	5/8
Top, inches (see Note 1)	3/4	1

NOTE: 1: In recess for closure cap for inside container, one-fourth inch thickness is permissible; closure cap shall not be in contact with inside of top section.

(2) Single bottle cases:

	Nominal capacity of inside containers			
	Pint	Quart	5 Pints	Gallon
Side wall, inches	5/8	5/8	3/4	1 1/2
Top wall, inches	3/4	3/4	3/4	1
Bottom wall, inches	1	1	3/4	1 1/2

4. Closing for shipment. (a) Cases shall be closed for shipment with a pressure-sensitive tape having a tensile strength of not less than 55 pounds per inch of width or tape of equivalent strength. The tape shall completely encircle the case, with overlap of not less than one inch, in one direction so as to transverse the joint of the two sections perpendicularly. If the design of the case is such that the tape is subject to abrasion in transportation and handling, tape shall also be applied similarly on the same axis, but at 90°.

(1) For multiple bottle case, tape width shall not be less than 1¼ inches.

(2) For single bottle case, tape width shall not be less than ¾ inch.

5. Gross weight authorized. (a) Multiple bottle case, 60 pounds maximum.

(b) Single bottle case, 20 pounds maximum.

6. Test for completed package. (a) Cases, with inside containers filled with water enclosed as for shipment, shall be capable of withstanding 4-foot flat drops onto solid concrete without leakage from or breakage of any inside container, and without producing any condition that would result in potential damage to the inside containers. A minimum of 4 cases shall be tested, each case not being subjected to more than one test. Each test is to consist of six 4-foot drops once each side, bottom and top.

(b) Tests prescribed by paragraph (a) of this section must be conducted by the shipper assembling the completed package prior to initial use, and each 6 months thereafter. The tests must also be repeated on the change of any components or design of the package. Records of tests and results must be maintained for at least one year.

7. Marking. (a) On each container. Symbol as follows:

CTC-33A

These marks shall be understood to certify that the outer container complies with all the construction requirements of the specification.

(1) The letters NRC, located just above or below the CTC mark, to indicate a nonreusable container.

(2) Name or symbol (letters) of manufacturer and plant making the case or other party assuming the responsibility for compliance with this specification; these must be registered with the Bureau of Explosives through the Canadian Transport Commission. These markings shall be located on the same face as the other marks specified in this paragraph.

(3) Size of markings. Specification markings prescribed in this paragraph must be at least ¼ inch high; all markings must be legible.

Specification 34

REUSABLE MOLDED POLYETHYLENE CONTAINER

For use without overpack.
Removable head not authorized.

1. Compliance. (a) Required in all details.

2. Material. (a) Drums shall be made of a polyethylene resin having the following properties which has not been used previously. Regrind from the same production process may be used.

Property	Specification	ASTM method
Melt index	1.2 maximum	D 1238 (62T)
Density range	0.941–0.965	D 1505 (63T)
Tensile strength	3000 psi minimum	D 638 (61T)
Per cent elongation	75 per cent minimum	D 638 (61T)

(b) Ultraviolet light protection shall be provided by impregnation of polyethylene with carbon black or other equally efficient pigments or inhibitors. These additives must be compatible with lading and must retain their effectiveness for the life of the container.

(c) Other materials may be added provided they do not adversely affect the physical properties specified in paragraph (a) of this section or the performance specified in § 7.

3. Construction and capacity. (a) Container must be constructed in accordance with the following table:

Marked (rated) capacity not over (gallons)[1]	Minimum thickness (inches) measured on any point of container
2½ thru 5½	0.045
13	.075
25	.125
46	

[1]Minimum actual capacity shall not be less than rated capacity plus 4 per cent. Maximum actual capacity shall not be greater than rated capacity plus 15 per cent for containers up to 13 gallons and shall not be greater than rated capacity plus 10 per cent for containers 13 gallons and over

4. Closure. (a) Openings shall not exceed 2.7 inches in diameter.

(b) Closures shall be of material resistant to lading and adequate to prevent leakage under tests prescribed in § 7 and under conditions incident to transportation.

(c) Vented closures where specified in Part 73 are authorized.

5. Defective containers. (a) Containers with repaired bodies not authorized.

6. Marking. (a) Each container must be permanently marked by embossment in letters and figures at least ½ inch in size as follows:

(1) CTC-34**; stars to be replaced by the rated capacity of the container (for example, CTC-34-5). These marks shall be understood to certify that the container complies with all specification requirements.

(2) Month and year of manufacture; name of maker or maker's symbol (symbol, if used, must be registered with the Commission). For example, CTC-34-5-6/65 to indicate a container of 5 gallons capacity made in June 1965.

7. Tests. (a) At least three samples taken at random filled and prepared as specified and closed as for use, shall be capable of withstanding the tests in subparagraphs (1), (2) and (3) of this paragraph without leakage. These tests shall be performed at the start of initial production and at four-month intervals and shall be repeated on any change of type, size, materials, or process method. No single container shall be expected to withstand more than one of the following tests:

(1) The container filled to 98 per cent capacity with water shall be dropped from a height of 4 feet onto solid concrete so as to drop diagonally on top edge or any part constructed to a lesser strength.

(2) The container filled to 98 per cent capacity with a solution compatible with polyethylene and which remains liquid at 0°F. shall be dropped from a height of 4 feet onto solid concrete on any part of the container when container and contents are at or slightly below 0°F. Filled container shall be stored at 0°F. or lower temperature for at least 4 hours immediately preceding test.

(3) The container shall be tested by retaining for five minutes hydrostatic pressure of at least fifteen pounds per square inch at equilibrium without showing pressure drop or evidence of leakage.

(b) At least three containers taken at random from each continuous production lot of not more than 1,000 containers of each given type and size shall withstand without leakage or failure the test prescribed in § 7(a)(2).

(c) At least three containers of each size and type taken at random at start of initial production, and upon any change in materials, design, or process method shall withstand without failure or leakage the following tests. NO single container shall be expected to withstand more than one test:

(1) The container filled to 98 per cent of capacity with water shall be capable of withstanding a vibration test by placing the container on the vibration table anchored in such manner that all horizontal motion shall be restricted and only vertical motion allowed. The test shall be performed for one hour using a vertical double amplitude (peak-to-peak displacement) of one inch at a frequency that causes the test container to be raised from the floor of the table to such a degree that a piece of paper of flat steel strap or tape can be passed between the table and the container.

(2) The container filled to 98 per cent capacity with water shall withstand the following static compression test without buckling of the side walls sufficient to cause damage, but in no case shall the maximum top to bottom deflection be more than one inch. Compression shall be applied to the load bearing areas of the top of the container for a period of not less than 48 hours.

Marked (rated) capacity (gallons)	Compression test (pounds)
2½ thru 5½	600
13	1200
25	1800
46	2400

(d) Records of test results to be maintained in current status and retained by each manufacturer at each producing plant.

Specification 35

NON-REUSABLE MOLDED POLYETHYLENE DRUM FOR USE WITHOUT OVERPACK: REMOVABLE HEAD REQUIRED.

1. Compliance. (a) Required in all details.

(b) Except as otherwise provided in this section, each drum must comply with the requirements of § 73.24 of these regulations.

(c) Each drum must be capable of withstanding the performance tests prescribed in sections 13 and 16 without failure.

4. Material. (a) Containers shall be made of an injection molding grade of high density polyethylene resin which has not been used previously. Regrind from the same production process may be used.

Property	Specification	ASTM method
Density range	0.941 to 0.965	D-1505-68
Tensile strength	3,000 lb/in.^{2}, minimum.	D-638-76
Percent elongation	75% minimum	D-638-76

Drums molded of such resin must comply with the performance testing requirements prescribed in section 13. The drum manufacturer shall retain data relating to the density and melt

index of each "as-received" lot of molding resin at the start of production.

The data must indicate the method used to obtain the numerical values and include all parameters (e.g., method of preparing test specimens; number of specimens tested; speed of testing; type of test specimens and dimensions, etc.) relative to test conditions. (ASTM methods may be cited where applicable.) Data on the above material properties shall be recorded and retained for each lot (i.e. quantity of material bearing the same manufacturer's lot identification number) of molding resin processed into drums. Records of the data, as well as a 100-gram sample of the resin, its lot identification number, and at least three drums molded from the resin, shall be retained for at least one year by each mold at each producing plant.

(b) Ultraviolet light protection may be provided by impregnation of polyethylene with carbon black or other equally efficient pigments or inhibitors. If used, these additives must be compatible with lading.

(c) Other materials may be added provided they do not adversely affect the physical properties specified in paragraph (a) of this section or the performance specified in section 13 and are compatible with the lading.

(d) Steel used in top head of drum must be low carbon of standard commercial quality.

7. Construction and capacity. (a) Rated capacity: Not to exceed 6 gallons. Minimum actual capacity shall not be less than rated capacity plus 4 percent. Maximum actual capacity shall not be greater than rated capacity plus 10 percent.

(b) Minimum thickness of drum measured at any point may not be less than 0..065-inch. If top head is constructed of steel, a minimum of 26-gauge steel must be used.

(c) The gross weight of each drum, when filled, may not exceed the maximum allowable gross weight indicated by the marking on the drum.

10. Closure. (a) Top head must be of the full removable type, and must be made of steel, polyethylene, or combination thereof. Steel top head must have no less than 16 lugs spaced no more than 1/4-inch apart, or be attached to body by tin plate ring seal. Gaskets required when necessary to meet the performance tests prescribed in section 13.

(b) Openings in body of drum are not authorized.

13. Design qualification tests. (a) The following tests must be performed at the start of production on each drum size and design. If any change is made to drum design, size, material used, or process, tests in this section must be repeated. Product leakage in any of the required tests will constitute a failure. No single drum will be expected to withstand more than one of the following tests:

(1) Drop test. Sample drums of each size and design, selected at random must be filled to marked gross weight at normal outage with dry powder material and then topped with a minimum of one inch of sodium bicarbonate and closed as for use. Each test drum and contents must be conditioned to be at a temperature of 0°F. or below at the start of each drop test and must be observed immediately following each drop test for any evidence of leakage.

(i) Test drums must be dropped from a height of four feet onto solid concrete under the following conditions of orientation:

(A) Three drums must be dropped flat on bottom.

(B) Three drums must be dropped diagonally on top chime or edge.

(C) Three drums, oriented to impact on bail ear, must be dropped flat on side.

(ii) In event of failure, the individual orientation drop test causing the failure must be repeated with six additional drums. Failure of any of the six additional drums disqualifies that size or design from this specification until design qualification tests have been successfully repeated.

(2) Vibration test. Sample drums, three of each size and design, selected at random, must be filled and closed as for use as required in subparagraph (13)(a)(1). The three fully loaded test drums must be placed on a platform that has a vertical double-amplitude (peak-to-peak displacement) of one inch. The drums should be constrained horizontally to prevent them from falling off the platform, but otherwise left free to move vertically, bounce and rotate. The test must be performed for one hour at a frequency that causes the drum to be raised from the vibrating platform to such a degree that a piece of material of approximately 1/16-inch thickness (such as steel strapping or paperboard) can be passed between the bottom of any drum and the platform. Immediately following the period of vibration, each drum must be removed from the platform, turned on its side and observed for any evidence of leakage. If failure (leakage) occurs, the vibration test must be repeated on three additional drums without any leakage of contents. Failure of any one of the three additional drums disqualifies that size or design from this specification until design qualification tests have been successfully repeated.

(3) Static compression test. Two drums must be filled and closed as for use as required in subparagraph (13)(a)(1) and conditioned so that drums and contents are at a temperature of 130°F. or higher at the start of each compression test. The two drums of identical capacity, stacked two high, must withstand a static compression test applied evenly for 48 hours to the top rim of the top drum without buckling of the side wall or leakage. The compression weight load to be applied must be the greater of 300 pounds or the volume in gallons of one drum times 85 pounds. Total top to bottom deflection of both drums may not exceed one inch. At the conclusion of the 48-hour test period, each drum must be turned on its side and observed for any evidence of leakage. If leakage occurs, or deflection exceeds the limits established above, the drum size or design is disqualified from this specification until design qualification tests have been successfully repeated.

(4) Reports and records. The manufacturer shall prepare a report on the tests prescribed in subparagraphs (a)(1), (2), and (3) of this section and shall retain the report on the results of these tests for at least two years from date of tests. A copy of these reports must be retained by the manufacturer at each producing plant.

16. Periodic testing. (a) At least one sample of each size and design of drum must be drop tested at each production plant from every 10,000 drums produced by each molding machine. As an alternative, the drop tests may be conducted once every 24 hours of uninterrupted production from each machine or at the resumption of production from a machine after shut down for one hour or more. No one drum will be expected to withstand more than one drop. Product leakage

from drum in any of the following tests will constitute a failure. Tests must be as follows:

(1) One drum, filled and closed as for use as provided in subparagraph (13)(a)(1) must be dropped onto solid concrete from a height of four feet diagonally on its top chime or edge.

(2) One drum, filled and closed as for use as provided in subparagraph (13)(a)(1) must be dropped onto solid concrete from a height of four feet flat on its side. The drum must be oriented to impact on bail ear.

(b) Failure of drum when tested as described above disqualifies that size or design from this specification until design qualification tests have been successfully repeated.

19. Markings. (a) Markings must be legible, in characters at least ¼-inch in height, and embossed on the bottom of each drum. The marking requirements of § 73.24 with the exception of subparagraph (c)(1)(ii) thereof are applicable.

(b) The markings must be as follows:

(1) CTC-35-*; star to be replaced by maximum allowable gross weight in pounds (for example, CTC-35-50).

(2) "NRC" located near the CTC mark to indicate "non-reusable container."

(3) Month and year of manufacture, for example, CTC-35-20-2/74, to indicate the drum specification, maximum allowable gross weight, and that the drum was manufactured in February 1974.

(4) Registration number of the manufacturer.

(c) A drum may not be marked with the specification identification "CTC-35" unless its manufacturer has a registration number approved by the Commission.

Specification 36A
LINED CLOTH BAGS (TRIPLEX)

1. Compliance. (a) Required in all details.

2. Capacity. (a) Not over 100 pounds, net.

3. Cloth. (a) Osnaburg cotton cloth at least 8½ ounces per square yard.

NOTE 1: Until further order of the Commission, cloth of 40-inch width, 2.11 yards per pounds, may be used provided creped paper is of two-way stretch construction.

4. Paper. (a) Shipping sack Kraft, creped. A "ream" as used herein means 500 sheets 24″ × 36″ before creping.

5. Assembly.(a) Either of the following:

(1) Single bag. Cloth-lined with 2 sheets of creped paper, each at least 35 pounds per ream, cemented together and to cloth. Combined tensile strength at least 100 pounds, warp and fill.

(2) Triple bag. Outer of cloth; intermediate of 2 thicknesses of creped paper, each at least 30 pounds per ream,

cemented together with asphalt so as to weigh 90 pounds per ream; inner of creped paper at least 45 pounds per ream.

6. Seams. (a) To be dust-tight.

7. Test. (a) The finished container, filled and closed as for shipment, must be capable of withstanding drop test of 4 feet without sifting.

8. Marking. (a) Marking on each container by marks at least 1″ high as follows:

(1) CTC-36A; this mark shall be understood to certify that the container complies with all specification requirements.

(2) Name and address of maker; located above or below the mark specified in (a) (1) of this section; symbol (letters) authorized if registered with the Bureau of Explosives through the Commission.

9. Closing for shipment. (a) By double tying with steel wires at least No. 16 Birmingham wire gauge; inner bags, if any, to have edger rolled in before outer bag is tied.

Specification 36B

BURLAP BAGS—LINED

1. Compliance. (a) Required in all details.

2. Capacity. (a) Not over 100 pounds, net.

3. Burlap. At least equal in quality and strength to 10-oz., 40″ (10/40), Calcutta A and/or B mill grade. Thread count at least 11 per 37/40″, porter and 12 per inch, shot; this to be an average of 6 counts.

4. Paper. (a) Shipping sack Kraft, creped; at least 25 pounds per ream (500 sheets 24″ × 36″) before creping.

5. Assembly. (a) Burlap to be lined with 2 sheets of creped paper cemented together and to burlap.

(b) Adhesive between paper sheets to be asphalt, melting point 150°F., at minimum rate of 110 pounds per ream.

(c) Adhesive between paper and burlap to be either:

(1) Curing rubber latex at minimum rate of 40 pounds, dry weight, per ream.

(2) Asphalt, any desirable type, at minimum rate of 110 pounds per ream.

6. Stretch of paper lining. (a) At least equal to that of burlap in direction of warp and fill and equal to 10 per cent in diagonal direction.

7. Seams. (a) By cementing or taping to give seam strength at least equal to that of bag material and prevent sifting.

8. Test. (a) The finished container, filled and closed as for shipment, must be capable of withstanding drop test of 4 feet on the butt without sifting or rupture of burlap or liners.

9. Marking. (a) Marking on each container by marks at least 1″ high as follows:

(1) CTC-36B; this mark shall be understood to certify that the container complies with all specification requirements.

(2) Name and address of maker; located above or below the mark specified in paragraph (a)(1) of this section; symbol (letters) authorized if registered with the Bureau of Explosives through the Commission.

10. Closing for shipment. (a) As specified for seams, sec. 7; or, by tying with 2 steel wires of at least No. 16 Birmingham wire gauge.

Specification 36C

BURLAP BAGS, PAPER LINED

1. Compliance. (a) Required in all details.

2. Capacity. (a) Not over 100 pounds, net.

3. Burlap. (a) At least equal in quality and strength to 7½ ounce, 40 inch (7½/40) Calcutta A and/or B mill grade. Thread count at least 9 per 37/40 inch, porter, and 9 per inch, shot; this to be an average of 6 counts.

4. Paper. (a) Shipping sack Kraft, creped; at least 30 pounds per ream (500 sheets 24″ × 36″) before creping.

5. Assembly. (a) Burlap to be lined with 1 sheet of creped paper cemented to burlap.

(b) Adhesive between paper and burlap to be asphalt, any desirable type, at a minimum rate of 110 pounds per ream.

6. Stretch of paper lining. (a) At least equal to that of burlap in direction of warp and fill and equal to 10 per cent in diagonal direction.

7. Seams. (a) By cementing or taping to give seam strength at least equal to that of bag material and prevent sifting.

8. Test. (a) The finished container, filled and closed as for shipment, must be capable of withstanding drop test of 4 feet on the butt without sifting or rupture of burlap liners.

9. Marking. (a) Marking on each container by marks at least 1 inch high, as follows:

(1) CTC-36C; this mark shall be understood to certify that the container complies with all specification requirements.

(2) Name and address of maker; located above or below the mark specified in subparagraph (1) of this paragraph; symbol (letters) authorized if registered with the Bureau of Explosives through the Commission.

10. Closing for shipment. (a) As specified for seams, sec. 7; or, by tying with 2 steel wires of at least No. 16 Birmingham wire gauge, or any other type of equal efficiency that will be sift-proof and insure equal strength to body of bag.

Specification 37A

STEEL DRUMS

Single-trip container. Removable head required.

1. Compliance. (a) Required in all details.

2. Rated capacity. (a) Rated capacity as marked, see paragraph 9(a)(2). Minimum actual capacity of containers shall be not less than rated (marked) capacity plus 4 per cent for containers not over 10 gallons capacity. Maximum actual capacity of containers not over 10 gallons capacity shall be not greater than rated (marked) capacity plus 5 per cent or rated (marked) capacity plus 4 per cent plus 1 quart whichever is the greater; for others, minimum actual capacity shall be not less than rated (marked) capacity plus 2 per cent and maximum actual capacity shall not be greater than rated (marked) capacity plus 3 per cent or rated (marked) capacity plus 2 per cent plus 1 quart whichever is the greater.

3. Composition. (a) Sheets for body and heads to be hot-rolled or cold-rolled, low carbon, open-hearth or electric steel of standard commercial quality.

5. Seams. (a) Side seams must be welded; or locked and soldered when 28-gauge tin plate is used for containers of 2-gallon capacity or less.

6. Capacities, weights, type and gauges. (a) Capacities, weights, type, and gauges must be as follows:

Marked capacity not over (gallons)	Authorized gross weight not over (pounds)	Type of container	Minimum thickness, uncoated sheets[1] (gauge)		Minimum ring gauge bolted type[2]
			Body sheet	Head sheet	
2	40	Straight side	28	28	Lug
5	60	Straight side	26	26	Lug or plain ring
5	80	.. do	24	24	seal
8½	160	.. do	24	24	
46	150	.. do	26	26	18, plain
46	275	.. do	24	24	18, plain
46	350	.. do	24	24	16, 2″ overlap
46	480[4]	.. do	22	22	16, 2″ overlap

[1]All gauges specified are minimum except as provided by Part 73. Heavier (but not lighter) gauges may be specified if shipper so desires.

[2]Equally efficient closing devices may be authorized by the Commission or Bureau of Explosives upon demonstration of their ability to withstand tests prescribed in paragraph 11.

[3]Containers of 13½ gallons capacity and over must have 2 swedged or corrugated rolling hoops of sufficient height to clear the closing device when the drum is rolled.

[4]A gross weight of 490 pounds is authorized when defined by Part 73 (see subparagraph (a) (2) § 73.164).

(b) Steel sheets of specified gauges shall comply with the following:

Gauge No.	Nominal thickness[1] (inch)	Minimum thickness[1] (inch)
22	0.0299	0.0269
24	0.0239	0.0209
26	0.0179	0.0159
28	0.0149	0.0129

[1]Thickness shall be measured at any point on the sheet not less than 3/8 inch from an edge.

7. Closures. (a) Closures of the type specified in the above table adequate to prevent leakage; gaskets required, all closures to be of the full-removable head type. Curl at top of shell for all drums 25 gallons capacity and larger must have a minimum diameter of 7/16 inch, and so made as to form a circular section with the under portion substantially in contact with the vertical shell. The removable head must have a minimum depth of ¾ inch and the cover bib must be large enough to extend to the horizontal centre line of the top curl when the drum is sealed with the gasket in place. Drums of less than 25 gallons capacity may be made with an outside curl diameter of ⅜ inch minimum and a head depth of ¾ inch minimum; except that for drums less than 13 gallons capacity the outside curl diameter may be 9/32 inch and the cover depth may be ⅜ inch minimum.

(b) The closing ring must be so constructed that the bottom leg will extend well inside the vertical centre line of the shell curl but must not touch the shell (recommended clearance is 1/16 inch minimum, 3/32 inch maximum) when sealed for usage. The top leg of the locking ring must have sufficient length to extend well inside the vertical centre line of the curl on the shell. Closing rings must have a 2 inch overlap at joint when gross weight of drum exceeds 275 pounds. Overlap is not required for drums of 275 pounds or less gross weight. The clearance between ends of rings without overlap should be a minimum of ⅛ inch and a maximum of ½ inch.

(c) Closures or fittings in the removable head of any type capable of withstanding test prescribed by paragraph 11 are authorized.

8. Defective containers. (a) Defective containers to be repaired by method used in constructing container. Soldering not authorized, except for tin plated steel as authorized by para. 5.

9. Marking. (a) Marking on each container by embossing on head, except that such embossment must be on the permanent head for drums having removable heads, with raised marks, or by embossing or die stamping on footring on drums equipped with footrings, or on metal plates securely attached to drum by brazing or welding not less than 20 per cent of the perimeter, as follows:

(1) CTC-37A***. Stars to be replaced by the authorized gross weight, or less, at which the container was type tested (for example, CTC-37A150). This mark shall be understood to certify that the container complies with all specification requirements.

(2) Gauge of metal in thinnest part, rated capacity in gallons, and year of manufacture (for example 24-46-54). When gauge of metal in body differs from that in either head, both must be indicated with slanting line between and with gauge of body indicated first (for example, 22/24-46-54 for a container having 22 gauge body, 22 gauge bottom head and 24 gauge top head).

(3) Name or symbol (letters) of maker; this must be recorded with the Bureau of Explosives through the Canadian Transport Commission.

(4) The letters STC; located near the CTC mark to indicate "single-trip container".

10. Size of markings. (a) Size of markings, not less than ½ inch high for all containers.

11. Type test. (a) Samples, taken at random and closed as for use, shall withstand prescribed test without leakage. Tests to be made of each type and size by each company starting production and to be repeated every four months. Samples last tested to be retained until further tests are made or for one year, whichever period is shorter. The type test is as follows:

(b) Test by dropping on top chime, or other part considered to be weaker, with drum filled to normal loading depth and to the gross weight at which container is marked with dry powdered material, and topped with at least two inches of a finely divided, dry, free-flowing powder of the following sieve analysis:

% retained on 42 mesh—Trace (max.)
% retained on 50 mesh—3% (max.)
% retained on 100 mesh—88% (min.)

A material such as sodium bicarbonate is recommended. Container shall be dropped from a height of 4 feet onto solid concrete so as to strike diagonally on the chime and so positioned when equipped with bolted ring type closure that crush pattern will terminate at closure joint. Closing devices and other parts projecting beyond chime or rolling hoops must be capable of withstanding this test. No disc or material other than regular gaskets in closure part is permitted for test purposes.

Specification 37B
STEEL DRUMS

Single-trip container. Removable head not authorized

1. Compliance. (a) Required in all details.

2. Rated capacity. (a) Rated capacity as marked, see paragraph 9(a) (2). Minimum actual capacity of containers shall be not less than rated (marked) capacity plus 4 per cent for containers not over 10 gallons capacity. Maximum actual capacity of containers not over 10 gallons capacity shall be not greater than rated (marked) capacity plus 5 per cent or rated (marked) capacity plus 4 per cent plus 1 quart whichever is the greater; for others, minimum actual capacity shall be not less than rated (marked) capacity plus 2 per cent and maximum actual capacity shall not be greater than rated (marked) capacity plus 3 per cent or rated (marked) capacity plus 2 per cent plus 1 quart whichever is the greater.

3. Composition. (a) Sheets for body and heads to be hot-rolled or cold-rolled, low carbon, open-hearth, or electric steel of standard commercial quality.

5. Seams. (a) Side seams may be welded, Gordon lock, or other equally efficient construction.

6. Capacities, weights, type and gauges. (a) Capacities, weights, type and gauges must be as follow:

Marked capacity not over (gallons)	Authorized gross weight not over (pounds)	Type of container	Minimum thickness, uncoated sheets (gauge)	
			Body sheet[1]	Head sheet
5	60	Straight side....	28	28
46	275	.. do	26	26
46	450	.. do	24	24
46	650	.. do	22	22[2]

[1] Containers of 13 gallons capacity and over must have small or series corrugations rolled into the shell or two swedged or corrugated rolling hoops.
[2] Twenty-four (24) gauge top head and cover authorized.

(b) Steel sheets of specified gauges shall comply with the following:

Gauge No.	Nominal thickness[1] (inch)	Minimum thickness[1] (inch)
22	0.0299	0.0269
24	0.0239	0.0209
26	0.0179	0.0159
28	0.0149	0.0129

[1]Thickness shall be measured at any point on the sheet not less than ⅜ inch from an edge.

7. Closures. (a) Closures shall be of any type that will withstand prescribed drop tests without leakage, see paragraph 11. Openings shall not exceed 9 inches in diameter in containers of 13-gallon capacity and larger nor 6½ inches in diameter in containers less than 13-gallon capacity. Larger openings may be authorized upon demonstration and proof of satisfactory closure test to the Commission or Bureau of Explosives. Gaskets required when necessary.

8. Defective containers. (a) To be repaired by method used in constructing container except that Gordon lock, or other similarly constructed seam must be welded. Soldering not authorized.

9. Marking. (a) Marking on each container by embossing on head with raised marks, or by embossing or die stamping on footring on drums equipped with footrings, or on metal plates securely attached to drum by brazing or welding not less than 20 per cent of the perimeter, as follows:

(1) CTC-37B***. Stars to be replaced by the authorized gross weight, or less at which container was type tested (for example, CTC-37B450, etc.). This marking shall be understood to certify that the container complies with all specification requirements.

(2) Gauge of metal in thinnest part (except closure cover), rated capacity in gallons, and year of manufacture (for example, 24-46-54). When gauge of metal in body differs from that in either head, both must be indicated with slanting line between and with gauge of body indicated first (for example 22/24-46-54 for a container having 22-gauge body, 22-gauge bottom head and 24-gauge top head).

(3) Name or symbol (letters) of maker; this must be recorded with the Bureau of Explosives through the Canadian Transport Commission.

(4) The letters STC; located near the CTC mark to indicate "single-trip container".

10. Size of markings. (a) Size of markings (minimum), not less than ½ inch high for all containers.

11. Type test. (a) Samples, taken at random and closed as for use, shall withstand prescribed test without leakage. Test to be made of each type and size by each company starting production and to be repeated every four months. Sample last tested to be retained until further tests are made, or for one year, whichever period is shorter. The type test is as follows:

(b) Test by dropping on top chime, filled with dry finely powdered material to the gross weight at which container is marked, from a height of 4 feet onto solid concrete so as to strike diagonally on the chime and so positioned as to strike, in the case of offset openings, at the point on the chime nearest the opening. Closing devices and other parts projecting beyond chimes must also be capable of withstanding this test.

Specification 37C
STEEL DRUMS

Nonreusable container. Removable head required.

1. Compliance. (a) Required in all details.

2. Rated capacity. (a) Rated capacity as marked (see paragraph 8). Maximum actual capacity of containers shall be not greater than rated (marked) capacity plus 5 per cent or rated (marked) capacity plus 4 per cent plus 1 quart whichever is the greater.

3. Composition. (a) Sheets for body and heads to be hot-rolled or cold-rolled, low carbon, open-hearth or electric steel of standard commercial quality.

4. Seams. (a) Side seams must be welded.

5. Capacities, weights, type and gauges. (a) Capacities, weights, type and gauges must be as follows:

Marked capacity not over (gallon)	Authorized gross weight not over (pounds)	Type of container	Minimum thickness, uncoated sheets (gauge)		
			Body sheet	Bottom head sheet[1]	Removable head sheet[2,3]
5	80	Straight side	28	28	26

[1]Bottom head must have three inwardly embossed circumferential heads.
[2]Removable head must have two inwardly embossed circumferential heads.
[3]Removable head must have not less than 16 lugs spaced not more than 1/4 inch apart.

(b) Steel sheets of specified gauges shall comply with the following:

Gauge No.	Nominal thickness[1] (inch)	Minimum thickness[2] (inch)
26	0.0179	0.0159
28	0.0149	0.0129

[1]Thickness shall be measured at any point on the sheet not less than 3/8 inch from an edge.

6. Closures. (a) Closures shall be capable of withstanding test prescribed by paragraph 10. Removable head may be equipped with leakproof fittings for filling.

7. Defective containers. (a) Defective containers to be repaired by method used in constructing container.

8. Marking. (a) Marking on each container by embossing on the permanent head as follows:

(1) CTC-37C**. Stars to be replaced by the authorized gross weight, or less, at which container was type tested (for example, CTC-37C80). This mark shall be understood to certify that the container complies with all specification requirements.

(2) Gauge of metal in thinnest part, rated capacity, and year of manufacture (for example, 26-5-64). When gauge of metal in body differs from that in either head, both must be indicated with slanting line between and with gauge of body indicated first (for example, 28/26-5-64) for a container having 28-gauge body, 28-gauge bottom head, and 26-gauge removable head.

(3) Name or symbol (letters) of maker or other party assuming responsibility for compliance with specification requirements; this must be recorded through the Commission with the Bureau of Explosives.

(4) The letters NRC; located near the CTC mark to indicate "nonreusable container."

9. Size of markings. (a) Size of markings, not less than ½ inch for all containers.

10. Type test. (a) Samples, taken at random and closed as for use, shall withstand prescribed test without leakage. Tests to be made of each type and size by each company starting production and to be repeated every four months. Samples last tested to be retained until further tests are made. The type test is as follows:

(b) Test by dropping on top chime, or other part considered to be weaker, with drum filled to normal loading depth and to the gross weight at which container is marked with dry powdered material, and topped with at least two inches of a finely divided, dry, free-flowing powder of the following sieve analysis:

% retained on 42 mesh—Trace (maximum)

% retained on 50 mesh—3% (maximum)

% retained on 100 mesh—88% (maximum)

A material such as sodium bicarbonate is recommended. Container shall be dropped from a height of 4 feet onto solid concrete so as to strike diagonally on the chime. Closing devices and other parts projecting beyond chime or rolling hoops must be capable of withstanding this test. No disc or material other than regular gaskets in closure part is permitted for test purposes.

Specification 37D
STEEL DRUMS

Nonreusable container. Open-head not authorized.

1. Compliance. (a) Each drum must meet the applicable requirements of § 73.24.

2. Rated capacity. (a) Rated capacity is 46 gallons, as marked (see Sec. 6).

(b) Actual capacity must be the rated capacity plus 4-5 per cent.

3. General construction requirements. (a) Chime reinforcement. The top and bottom chimes must be reinforced with a steel band that is an integral part of the double seam and which provides a chime cross section containing at least eight layers of steel. The reinforcing band must follow and support the knuckle radius of the head with the inside edge upturned so that the edge does not contact the adjacent portions of the head.

(b) Seams. The body side seam must be welded.

(c) Sidewall construction. A continuous series of parallel, geometrically similar circumferential beads must be expanded in the drum sidewall so that the surface length of the steel in the axial direction does not change more than 1 per cent during forming.

(d) Steel thickness. (1) The thickness of the body and heads of the finished drum must be at least 23-gauge.

(2) The chime reinforcement must be made of at least 18-gauge steel.

(e) Heads. Heads must be flat. Openhead drums are not authorized.

4. Closure. (a) The closing part (plug, cap, plate, etc.) must be of steel at least 23-gauge thickness, or other material of equivalent strength. Gaskets are required. Cap seals may be placed over the closure.

(b) For closures with threaded plug or cap, the seat (e.g., flange) for the plug or cap must have three or more threads. Two drainage holes of not over 5/16-inch diameter are authorized. The plug or cap must have a sufficient length of thread to engage at least three threads when securely tightened with the gasket in place.

(c) The maximum permitted closure opening is 2.7 inches in diameter.

5. Defective drums. Defects or damage must be repaired by the method used in constructing the drum. Soldering is not authorized.

6. Marking. (a) Marking must be as prescribed in § 73.24.

(b) The marking on each drum must be by embossing on the bottom head with raised marks as follows: "CTC-37D NRC"; and the gauge of the metal of the drum in the thinnest part, the rated capacity of the drum in gallons, and the year of manufacture (e.g., 23-46-70). When the gauge of the metal in the drum wall differs from that in the head, both must be indicated with a slanting line between, and with the gauge of the wall indicated first (e.g., 23/22-46-70).

(c) The minimum height of the letters and numerals shall be three-fourths inch.

(d) The depth of embossing must be at least 0.015 inch and not more than 0.025 inch, but in no case may the depth exceed the thickness of the metal sheet being embossed. The dies used to form the embossing marks must be free of sharp edges or corners that might cause a stress riser in the mark. The embossing marks must be at least 4 inches from the outside edge of the chime.

7. Tests. (a) Each drum must be capable of withstanding the prescribed tests without leakage of contents.

(b) Samples which are taken at random and closed as for use must be tested as prescribed in subparagraphs (1) and (2) of this paragraph without leakage. Tests are to be made of each type and size by each manufacturer starting production and are to be repeated at least every 4 months thereafter. The samples last tested must be retained by the manufacturer until further tests are made or for 1 year, whichever period is shorter.

(1) Drop test. Test by dropping, filled with water to 98 per cent capacity, from a height of 4 feet onto a solid unyielding surface (e.g., concrete or steel) so as to strike the surface diagonally on the chime. Additional similar drops must be made on any other parts of the drum which might be considered weaker than the chime. Closing devices and other parts projecting beyond the chime or side-wall beads must also be capable of withstanding this test.

(2) Pressure test. Hydrostatic pressure test of at least 15 pounds per square inch, sustained without pressure drop for at least 5 minutes.

(c) Leakage test. Each drum must be tested for leakage with seams under water, or covered with soap suds or heavy oil, or equivalent material. Interior air pressure of at least 7 pounds per square inch must be applied, and the seams and chimes examined for evidence of leakage. Leaking drums must be rejected, or repaired (see Sec. 5) and retested.

Specification 37K

STEEL DRUMS

Single-trip container. Removable head containers which will pass all required tests are authorized.

1. Compliance. (a) Required in all details.

2. Rated capacity. (a) Rated capacity as marked, see sec. 8 (a)(3). Actual capacity not less than rated (marked) capacity plus 2 per cent, nor greater than rated capacity plus 2 per cent plus 1 quart.

3. Composition. (a) Sheets for body and heads to be low carbon, open-hearth or electric steel.

5. Parts and dimensions. (a) Parts and dimensions as follows:

Marked capacity not over (gallons)	Authorized gross weight not over (pounds)	Type of container	Welded side seam required	Minimum thickness, uncoated sheets (gauge)	
				Body sheet	Head sheet
46	275	Straight side	Yes	22	22

(b) Steel sheets of specified gauges shall comply with the following:

Gauge No.	Nominal thickness[1] (inch)	Minimum thickness[1] (inch)
22	0.0299	0.0269

[1] Thickness shall be measured at any point on the sheet not less than 3/8 inch from an edge.

6. Closure required. (a) Adequate to prevent leakage; to be of bolted ring or lever lock ring types only; sponge rubber gaskets required; flowed-in-gaskets not permitted.

7. Defective containers. (a) Leaks and other defects to be repaired by method used in constructing container, not by soldering.

8. Marking. (a) Marking on each container by embossing on head, except that such embossment must be on the permanent head for drums having removable heads, with raised marks, or by embossing or die stamping on footring on drums equipped with footrings, or on metal plates securely attached to drum by brazing or welding not less than 20 per cent of the perimeter, as follows:

(1) CTC-37K275. This mark shall be understood to certify that the container complies with all specification requirements.

(2) Name or symbol (letters) of maker; this must be recorded with the Bureau of Explosives through the Canadian Transport Commission.

(3) Gauge of metal in thinnest part, rated capacity in gallons, and year of manufacture (for example, 18-46-50). When gauge of metal in body differs from that in head, both must be indicated with slanting line between and with gauge of body indicated first (for example, 14/12-46-50 for body 14 gauge and head 12 gauge).

(4) The letters STC; located near the CTC mark to indicate "single-trip container".

9. Size of markings. (a) Size of markings (minimum): ½" high for 25-gallon or less, ¾" for over 25 gallons.

10. Type test. (a) Samples, taken at random and closed as for use, shall withstand prescribed test without leakage. Tests to be made of each type and size by each company starting production and to be repeated every four months. Sample last tested to be retained until further tests are made, or for one year, whichever period is shorter. The type test is as follows:

(1) Test by dropping, filled with dry, finely powdered material to the authorized gross weight, from height of 4 feet on to solid concrete so as to strike diagonally on top chime. Closing devices and other parts projecting beyond chime or rolling hoops must also be capable of withstanding this test.

Specification 37M

Cylindrical steel overpack, straight sided for inside plastic container. Nonreusable containers.

1. Material requirements. (a) Sheets for body and heads to be low carbon, open hearth or electric steel.

2. Construction requirements. (a) Construction requirements are as follows:

Rated capacity of inside plastic container not over (gallons)	Minimum thickness, uncoated sheets (gauge)		Body seams	Rolling hoops	Top or bottom head	Closure when full removable head is used (gaskets not required)
	Body sheet	Head sheet				
5	26	26	Welded	None required	Double seamed	Lug or plain ring seal
12 1/2	24	24	Welded	Rolled or swedged	Double seamed	Lug or plain ring seal
25	24	24	Welded	Rolled or swedged	Double seamed	Bolted type ring closure, 18 gauge
46	24	24	Welded	Rolled or swedge	Double seamed	Bolted type ring closure, 16 gauge

(b) Steel sheets or parts of specified gauges shall comply with the following:

Gauge number	Nominal thickness (inch)[1]	Minimum thickness (inch)[1]
16	0.0598	0.0533
18	0.0478	0.0428
24	0.0239	0.0209
26	0.0179	0.0159

[1] Thickness shall be measured at any point on the sheet not less than 3/8 inch from an edge.

(c) Two holes not exceeding ¼ inch each are permitted diametrically opposite each other in the overpack body immediately above the double seam of the bottom chime or three holes not exceeding 3/16 inch in diameter on centers 120 degrees apart in the bottom head.

(1) Overpack interior shall be free of projections, burrs, or any edges that might cause damage to inside plastic container and shall be free of lubricants, oils, or any foreign matter.

(2) Top head may have not more than two holes of suitable size to provide for protruding closures.

(3) Overpack shall be constructed to provide snug fit for inside plastic container.

3. Tests. (a) Steel overpack when assembled as for use, shall withstand the tests prescribed in specifications for inside plastic containers when authorized as combination packages in Part 73. The completed package must withstand these tests without producing a condition of the overpack that could result in potential damage to the inside container.

4. Marking. (a) Marking on each container by embossing on bottom head with raised marks with letter and figures not less than ½ inch high as follows:

(1) CTC-37M. The letters NRC located near the CTC mark to indicate "Non-reusable container." These marks shall be understood to certify the steel container complies with all construction requirements of this specification.

(2) Name or symbol (letters) of maker; or other party assuming responsibility for compliance with specification requirements; this must be recorded with the Bureau of Explosives through the Commission.

(3) Gauge of metal in thinnest part, rated capacity of the inside container in gallons, and year of manufacture (for example, 24-46-62). When gauge of metal in body differs from that in either head, both must be indicated with slanting line between and with gauge of body indicated first (for example, 24/22-46-62 for a container having 24-gauge body and 22-gauge top head).

Specification 37P

STEEL DRUMS WITH POLYETHYLENE LINER

Nonreusable containers.

1. Compliance. (a) Required in all details.

2. Rated capacity of assembled composite containers. (a) Rated capacity as marked, see paragraph 9. Minimum actual capacity of containers shall be not less than rated (marked) capacity, plus 4 per cent. Maximum actual capacity shall not be greater than rated (marked) capacity, plus 5 per cent or rated (marked) capacity plus 4 per cent plus 1 quart whichever is the greater.

3. Steel composition. (a) Sheets for body and heads to be low carbon, open hearth or electric steel.

4. Seams. (a) Side seams welded.

(b) Chime of permanent head, double seamed.

5. Parts and dimensions. (a) Parts and dimensions shall be as follows:

Drums plastic liner of rated capacity not over (gallons)	Type of container[1,2]	Body sheet (gauge)	Bottom head sheet (gauge)	Removable head sheet (gauge)	Type of removable head closure
5	Straight side, single head	26	26	24	Ring seal, bolted ring, lug cover
5 1/2	Straight side, single head	24	24	24	Ring seal, bolted ring, lug cover
12 1/2	Straight side, single head[3]	22	22	19[4]	Ring seal, bolted ring, lug cover

[1] Drum interior shall be free of projections, burrs, or any edges that will cause damage to liners, and shall be free of lubricants, oil, or other foreign matter. Drum shall provide a snug fit for the plastic liner.

[2] One hole not over 3/16 inch in diameter permitted in body or a head, or two 1/8 inch holes in bottom head near the chime.

[3] For containers up to 10 gallons capacity, a single rolled or swedged head in body near top curl required; for containers of 10 gallons and greater capacity, 2 rolled or swedged rolling hoops in drum body required.

[4] Twenty (20) gauge authorized.

(b) Steel sheets of specified gauges shall comply with the following:

Gauge No.	Nominal thickness[1] (inch)	Minimum thickness[1] (inch)
19	0.0418	0.0378
20	0.0359	0.0324
22	0.0299	0.0269
24	0.0239	0.0209
26	0.0179	0.0159

[1] Thickness shall be measured at any point on the sheet not less than 3/8 inch from edge.

6. Liner. (a) Each metal drum shall contain a contour fitting polyethylene liner having heat-sealed seams or a one-piece seamless molded polyethylene unit, attached to the pour opening in the removable head so as to provide a container that is completely resistant to lading when closed as for use.

(b) Polyethylene liner or molded unit shall be fabricated throughout of virgin polyethylene tubing or mold material, which may include a low percentage of elastomeric polymer having minimum thickness of 0.010 inch and having the following physical properties;

(1) Resin should have a maximum melt index value of 1.8 plus 0.4 per 10 minutes, and shall have a minimum average molecular weight of 21,000, as determined in accordance with methods acceptable to the Commission or the Bureau of Explosives.

7. Closure. (a) Closure shall be resistant to lading and adequate to prevent leakage. Openings in removable head shall not be over 2.85 inches in diameter. Venting closures are permitted when required by Part 73.

8. Defective containers. (a) Repaired polyethylene liners are not authorized.

9. Marking. (a) Marking on the permanent head of each container by embossing with raised marks as follows:

(1) CTC-37P. The letters NRC located just above or below the CTC mark to indicate a nonreusable container. These marks shall be understood to certify that the container complies with all specification requirements.

(2) Name or symbol (letters) of maker; this must be recorded with the Bureau of Explosives through the Canadian Transport Commission.

(3) Gauge of metal in thinnest part, rated capacity of assembled composite container in gallons, and year of manufacture (for example, 24-5-57). When gauge of metal in body differs from that in head, both must be indicated with slanting line between and with gauge of body indicated first (for example, 26/24-5-57 for body 26-gauge and head 24-gauge).

10. Size of markings. (a) Size of markings (minimum) ½" high.

11. Type tests. (a) Three samples of each size container manufacture taken at random, filled with water to 98 per cent of actual capacity and closed as for use, shall withstand drop tests from height of 4 feet onto solid concrete as prescribed by subparagraphs (1), (2) and (3) of this paragraph, without leakage or potentially hazardous rupture of outside container. Tests shall be made at start of production

and repeated at 4-month intervals thereafter. Samples last tested shall be retained until subsequent tests are made or for one year, whichever period is shorter. No single container shall be expected to withstand more than one of the following:

(1) Diagonal drop on top chime.

(2) Diagonal drop on bottom chime.

(3) Flat drop on side of drum.

(b) Completely assembled composite containers of each size manufactured, filled to 98 per cent of actual capacity with water, shall be capable of withstanding a vibration test by placing the container on the vibration table anchored in such manner that all horizontal motion shall be restricted and only vertical motion allowed. The test shall be performed for one hour using an amplitude of one inch at a frequency that causes the test container to be raised from the floor of the table to such a degree that a piece of paper or flat steel strap or tape can be passed between the table and the container.

12. Test. (a) Each assembled container shall be tested by retaining at least 1½ pounds per square inch air pressure at equilibrium without showing pressure drop on a suitable gauge.

Specification 39

NON-REUSABLE—NON-REFILLABLE CYLINDER

1. Compliance. Each cylinder must meet the applicable requirements of § 73.24.

2. Type, size, service pressure, and test pressure. (a) Type: Each cylinder must be of seamless, welded, or brazed construction. Spherical pressure vessels are authorized and covered by references to cylinders in this specification.

(b) Size limitation: Maximum water capacity may not exceed:

(1) 55 pounds (1,526 cubic inches) for a service pressure of 500 psig. or less, and

(2) 10 pounds (277 cubic inches) for a service pressure in excess of 500 psig.

(c) Service pressure: The marked service pressure may not exceed 80 per cent of the test pressure.

(d) Test pressure: The minimum test pressure is the maximum pressure of contents at 130°F. or 180 psig. whichever is greater.

(e) The term "pressure of contents" as used in this specification means the total pressure of all the materials to be shipped in the cylinder.

3. Inspection by whom and where. (a) By competent and independent inspector approved by the Canadian Transport Commission.

(b) As a minimum requirement, all inspections and tests required by this specification, shall be carried out by an approved independent inspection agency at least once for an entire week's production.

4. Duties of inspector. (a) The inspector shall determine that all material used complies with the requirements of this specification.

(b) Verify compliance with the requirements of Sec. 5 by making a chemical analysis or obtaining a certified chemical analysis from the material manufacturer for each heat of material (ladle analysis acceptable). If an analysis is not provided by the material manufacturer, a sample from each coil, sheet, or tube must be analyzed.

(c) Determine that each cylinder is made and marked in compliance with this specification by:

(1) Complete internal and external inspection;

(2) Verification of proper heat treatment (if any);

(3) Selection of samples to be tested;

(4) Witnessing all tests; and

(5) By preparation of required report.

(d) Render complete report required by this specification to cylinder maker, Canadian Transport Commission and upon request to the purchaser.

5. Material; steel or aluminum. (a) Steel:

(1) The steel analysis must conform to the following:

	Ladle analysis	Check analysis
Carbon, maximum per cent	0.12	0.15
Phosphorus, maximum per cent	0.04	0.05
Sulphur, maximum per cent	0.05	0.06

(2) For a cylinder made of seamless steel tubing with integrally formed ends, hot drawn, and finished, content per cent for the following must not exceed: carbon, 0.55; phosphorous, 0.045; sulphur, 0.050.

(3) For non-heat treated welded steel cylinders, adequately killed deep drawing quality steel is required.

(4) Longitudinal or helical welded cylinders are not authorized for service pressures in excess of 500 psig.

(b) Aluminum: Aluminum not authorized for service pressures in excess of 500 psig. Analysis of aluminum must conform to Aluminum Association standard designated for alloys 1100, 1170, 3003, 5052, 5086, 5154, 6061, and 6063 specified in its publication entitled "Aluminum Standards and Data" (1970-71 edition dated December 1969).

(c) Material with seams, cracks, laminations, or other injurious defects not permitted.

(d) Material used must be identified by any suitable method.

6. Manufacture. (a) General manufacturing requirements are as follows:

(1) Dirt and scale must be removed prior to inspection and processing.

(2) The surface finish must be uniform and reasonably smooth.

(3) Inside surfaces must be clean, dry, and free of loose particles.

(4) No defect of any kind is permitted if it is likely to weaken a finished cylinder.

(b) Requirements for seams:

(1) Brazing is not authorized on aluminum cylinders.

(2) Brazing material must have a melting point of not lower than 1,000°F.

(3) Brazed seams must be assembled with proper fit to insure complete penetration of the brazing material throughout the brazed joint.

(4) Minimum width of brazed joints must be at least four times the thickness of the shell wall.

(5) Brazed seams must have design strength equal to or greater than 1.5 times the minimum strength of the shell wall.

(6) Welded seams must be properly aligned and welded by a method that provides clean, uniform joints with adequate penetration.

(7) Welded joints must have strength equal to or greater than the minimum strength of the shell material in the finished cylinder.

(c) Attachments to the cylinder are permitted by any means which will not be detrimental to the integrity of the cylinder. Welding or brazing of attachements to the cylinder must be completed prior to all pressure tests.

7. Wall thickness. (a) The minimum wall thickness must be such that the wall stress at test pressure does not exceed the yield strength of the material of the finished cylinder wall.

(b) Calculation of the stress for cylinders must be made by the formula:

$$S = \frac{P\ (1.3D^2 + 0.4d^2)}{D^2 - d^2}$$

where:

S = Wall stress, in psi.;
P = Test pressure;
D = Outside diameter, in inches;
d = Inside diameter, in inches.

(c) Calculation of the stress for spheres must be made by the formula:

$$S = \frac{PD}{4t}$$

where:

S = Wall stress, in psi.;
P = Test pressure;
D = Outside diameter, in inches;
t = Minimum wall thickness, in inches.

9. Openings and attachements. (a) Openings and attachments are permitted on heads only.

(b) All openings and their reinforcements must be within an imaginary circle, concentric to the axis of the cylinder. The diameter of the circle may not exceed 80 per cent of the outside diameter of the cylinder. The plane of the circle must be parallel to the plane of a circumferential weld and normal to the long axis of the cylinder.

(c) Unless a head has adequate thickness, each opening must be reinforced by a securely attached fitting, boss, pad, collar, or other suitable means.

(d) Material used for welded openings and attachments must be of weldable quality and compatible with the material of the cylinder.

10. Safety devices. Safety devices must meet the requirements of § 73.34 (d) of this chapter.

11. Pressure tests. (a) Each cylinder must be tested at an internal pressure of at least the test pressure and must be held at that pressure for at least 30 seconds.

(1) the leakage test must be conducted by submersion under water or by some other method that will be equally sensitive.

(2) If the cylinder leaks, evidences visible distortion, or any other defect, while under test, it must be rejected (see Sec. 13).

(b) One cylinder taken from the beginning of each lot, and one from each 1,000 or less successively produced within the lot thereafter, must be hydrostatically tested to destruction. The entire lot must be rejected if (see Sec. 13):

(1) A failure occurs at a gauge pressure less than 2.0 times the test pressure.

(2) A failure initiates in a braze or a weld or the heat affected zone thereof.

(3) A failure is other than in the side-wall of a cylinder longitudinal with its long axis, or

(4) In a sphere, a failure occurs in any opening, reinforcement, or at a point of attachment.

(c) A "lot" is defined as the quantity of cylinders successively produced per production shift (not exceeding 10 hours) having identical size, design, construction, material, heat treatment, finish, and quality.

12. Flattening test. (a) One cylinder must be taken from the beginning of production of each lot (as defined above) and subjected to a flattening test.

(1) The flattening test must be made on a cylinder that has been tested at test pressure.

(2) A ring taken from a cylinder may be flattened as an alternative to a test on a complete cylinder. The test ring must not include the heat affected zone or any weld. However, for a sphere, the test ring may include the circumferential weld if it is located at a 45 degree angle to the ring, ± 5 degrees.

(3) The flattening must be between 60 degrees included angle, wedge shaped knife edges, rounded to a 0.5 inch radius.

(4) Cylinders and test rings must not crack when flattened so that their outer surfaces are not more than six times wall thickness apart when made of steel or not more than ten times wall thickness apart when made of aluminum.

(b) If any cylinder or ring cracks when subjected to the specified flattening test, the lot of cylinder represented by the test must be rejected.

13. Rejected cylinders. (a) If the cause for rejection of a lot is determinable, and if by test or inspection defective cylinders are eliminated from the lot, the remaining cylinders must be qualified as a new lot under Sec. 11 and Sec. 12.

(b) Repairs to welds are permitted. Following repair, a cylinder must pass the pressure test specified in Sec. 11 (a).

(c) If a cylinder made from seamless steel tubing fails the flattening test described in Sec. 12, suitable uniform heat treatment must be used on each cylinder in the lot. All prescribed tests must be performed subsequent to this heat treatment.

14. Markings. (a) The marking required by this section must be durable and waterproof. The requirements of § 73.24 (c)(1)(iv) of this chapter do not apply to this section.

(b) Required markings are as follows:

(1) CTC-39.

(2) NRC.

(3) The service pressure.

(4) The test pressure.

(5) The registration number of the manufacturer.

(6) The lot number.

(7) The date of manufacture if the lot number does not establish the date of manufacture.

(c) the marking required by paragraph (b)(1) through (5) of this section must be in numbers and letters at least 1/8 inch high and displayed sequentially. For example:

CTC-39 NRC 250/500 1001.

(d) No person may mark any cylinder with the specification identification "CTC-39" unless (1) it was manufactured in compliance with the requirements of this section and (2) its manufacturer has a registration number.

15. Inspector's report. (a) The inspector's report must be retained by the manufacturer for a period of 3 years and must be available for examination by representatives of the Commission.

(b) The report must be legible, and contain at least the following information:

INSPECTION REPORT COVERING THE MANUFACTURE OF SPECIFICATION CTC-39 CYLINDERS OR SPHERES

The cylinders (spheres) covered by this report were manufactured for ..... located at ..... They were manufactured by .....located at ..... whose registration number is..... The cylinders are ..... inches in diameter (OD) and .....in length. The have a design test pressure of .....psig. and a marked service pressure of .....psig. Each has an internal volume of .....cubic inches (nominal)

These containers were made by process of.....

The metal used was identified by heat or analysis numbers as shown on the "Record of Chemical Analysis of Metal" attached hereto

All material and each cylinder was inspected. All accepted material was found free from seams, cracks, lamination, and other defects which might prove injurious to the strength of the cylinder. The processes of manufacture and heat treatment (if any) were observed and found satisfactory

My record of tests and inspection for each lot covered by this report is as follows:

Lot No.	Lot quantity	Lot tests		All cylinders	
		Burst-pressure[1]	Flattening test[2]	Pressure tests[2]	Visual inspection[2]

[1]Enter the lowest actual failure pressure of all cylinders tested within the lot.

[2]Enter "Pass" or "Foil".

Inspector's name (print) Inspector's signature

Date Inspector's employer (company name)

Specification 40 (Cancelled)

Specification 41 (Cancelled)

Specification 42B
ALUMINUM DRUMS

1. Compliance. (a) Required in all details.

2. Rated capacity. (a) Rated capacity as marked, see para. 9 (a) (3). Not less than 5 gallons; actual capacity shall be rated capacity plus at least 2 per cent.

3. Composition. (a) Body and heads of aluminum at least 99 per cent pure, or an aluminum base alloy of equivalent corrosion resistance and physical properties.

4. Outage. (a) Two per cent of rated capacity, plus a maximum tolerance of 1 quart.

5. Seams. (a) Welded, including attachment of flanges for closures and other devices. Circumferential seams at least 3" from top of chime; chime seams not permitted.

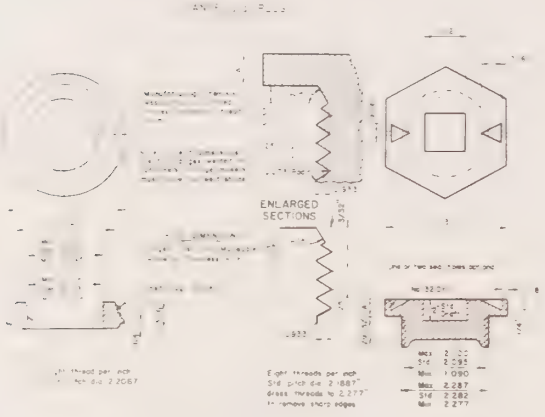
6. Parts and dimensions. (a) Parts and dimensions as follows:

Marked capacity not over (gallons)	Minimum thickness of material (inch)	Rolling hoops required, type authorized, and minimum dimensions	
		I-bar, size (inch)	U-type, aluminum, thickness (inch)
8½	0.110	¾ × 1¼	0.139
25	.154	¾ × 1¼	.193
46	.187	¾ × 1¼	.234
92	.230	1 × 1½	

(b) Rolling hoops must be firmly secured in place and not over 19 inches apart; beading under hoops not permitted. If welding is employed, the welding must be continuous on each edge of hoop.

7. Closures. (a) Of screw-thread type or secured by screw-thread device; openings over 2.3″ not authorized; suitable gaskets required.

(b) Threaded plugs, or caps, and flanges must be close fitting with gasket surfaces which bear squarely on each other when without gasket; they must have not over 8 threads per inch, with 5 complete threads engaged when gasket is in place, or not over 4 threads per inch, with 2 complete threads similarly engaged; two 5/16 inch drainage holes are authorized in flange. Thread form must conform to that shown by drawing below or be of a form that shall provide an equally efficient closure.



8. Projections. (a) Closing devices and other parts must not project beyond chime or rolling hoops.

9. Marking. (a) Marking on each container on top head by stamping with pressure dies, by embossing with raised marks, or plate attached by welding, as follows:

(1) CTC-42B. This mark shall be understood to certify that the container complies with all specifications requirements.

(2) Name or symbol (letters) of maker; this must be registered with the Bureau of Explosives through the Commission and located just above, below, or following the mark specified in paragraph (a)(1) of this section.

(3) Gauge of metal, Brown and Sharpe or equivalent decimal thickness in inches, at start of fabrication; rated capacity in gallons; year of manufacture (for example, 7-25-50 or .1442-25-50).

10. Size of marking. (a) Size of marking (minimum): ½″ high for 25-gallon and smaller containers, ¾″ for over 25 and not over 46 gallons, and 1″ for over 46 gallons.

11. Type tests. (a) Samples, taken at random and closed as for use, shall withstand prescribed tests without leakage. Tests to be made of each type and size by each company starting production and to be repeated every four months. Samples last tested to be retained until further tests are made or for one year, whichever period is shorter. The type tests are as follows:

(1) Test by dropping, filled with water to 98 per cent capacity, from height of 6 feet on to solid concrete so as to strike diagonally on chime, or when without chime seam, to strike on other circumferential seam; also additional test on any other parts which might be considered weaker than the chime.

(2) Hydrostatic pressure test of 60 pounds per square inch sustained for 5 minutes.

12. Leakage test. (a) Each container shall be tested, with seams under water or covered with soapsuds or heavy oil, by interior air pressure of at least 15 pounds per square inch. Equally efficient means of testing are authorized upon demonstration and proof of satisfactory tests to representative of the Commission or Bureau of Explosives. Leakers shall be rejected or repaired and retested.

13. Defective containers. (a) Leaks and other defects shall be repaired by welding, using welding material of the same composition as originally used by the manufacturer of the drum or other approved aluminum base alloy of equal corrosion and strength qualities.

Specification 42C

ALUMINUM BARRELS OR DRUMS

1. Compliance. (a) Required in all details.

2. Rated capacity. (a) Rated capacity as marked, see para. 9 (a)(3). Not less than 4 gallons; actual capacity shall be rated capacity plus at least 2 per cent.

3. Composition. (a) Body and heads of aluminum at least 99 per cent pure, or an aluminum base alloy of equivalent corrosion resistance and physical properties.

4. Outage. (a) Two per cent of rated capacity; plus a maximum tolerance of 1 quart.

5. Seams. (a) Welded, including attachment of flanges for closures and other devices. Circumferential seams at least 3″ from top of chime; chime seams not permitted.

6. Parts and dimensions. (a) Parts and dimensions as follows:

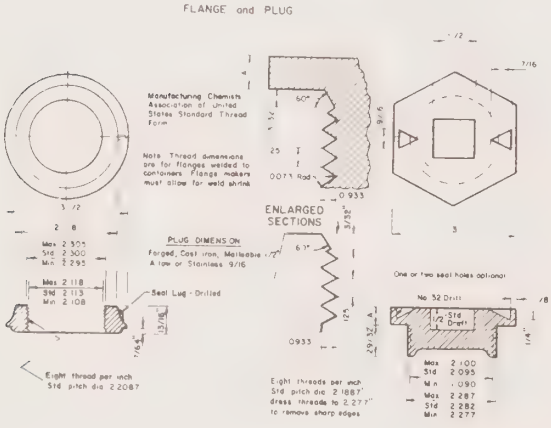
Marked capacity not over (gallons)	Type of container	Minimum thickness of material (inch)	Rolling hoops required, type authorized, and minimum dimensions	
			I-bar, size (inches)	U-type aluminum, thickness (inch)
8½	Straight side	0.093	¾ × 1¼	0.116
25	do	.129	¾ × 1¼	.161
46	do	.155	¾ × 1¼	.194
92	do	.192	1 × 1½	
12½	Bilge	.110	Expanded form shell.[1]	
25	do	.150	Do.	
46	do	.180	Do.	

[1]Only required when side openings are used.

(b) Rolling hoops must be firmly secured in place and not over 19 inches apart; beading under hoops not permitted. If welding is employed, the welding must be continuous on each edge of hoop.

7. Closures. (a) Of screw-thread type or secured by screw-thread device; openings over 2.3″ not authorized; suitable gaskets required.

(b) Threaded plugs, or caps, and flanges must be close fitting with gasket surfaces which bear squarely on each other when without gasket; they must have not over 8 threads per inch, with 5 complete threads engaged when gasket is in place, or not over 4 threads per inch, with 2 complete threads similarly engaged; two 5/16 inch drainage holes are authorized in flange. Thread form must conform to that shown by drawing below or be of a form that shall provide an equally efficient closure.



8. Projections. (a) Closing devices and other parts must not project beyond chime or rolling hoops.

9. Marking. (a) Marking on each container on top head, by stamping with pressure dies, by embossing with raised marks, or plate attached by welding, as follows:

(1) CTC-42C. This mark shall be understood to certify that the container complies with all specification requirements.

(2) Name or symbol (letters) of maker; this must be registered with the Bureau of Explosives through the Commission and located just above, below, or following the mark specified in paragraph (a)(1) of this section.

(3) Gauge of metal, Brown and Sharpe or equivalent decimal thickness in inches, at start of fabrication; rated capacity in gallons; year of manufacture (for example, 7-25-50 or .1442-25-50).

10. Size of marking. (a) Size of marking (minimum): ½″ high for 25-gallon and smaller containers, ¾″ for over 25 and not over 46 gallons, and 1″ for over 46 gallons.

11. Type tests. (a) Samples, taken at random and closed as for use, shall withstand prescribed tests without leakage. Tests to be made of each type and size by each company starting production and to be repeated every four months. Samples last tested to be retained until further tests are made or for one year, whichever period is shorter. The type tests are as follows:

(1) Test by dropping, filled with water to 98 per cent capacity, from height of 6 feet on to solid concrete so as to strike diagonally on chime, or when without chime seam, to strike on other circumferential seam; also additional test on any other parts which might be considered weaker than the chime.

(2) Hydrostatic pressure test of 60 pounds per square inch sustained for 5 minutes.

12. Leakage test. (a) Each container shall be tested, with seams under water or covered with soapsuds or heavy oil, by interior air pressure of at least 15 pounds per square inch. Equally efficient means of testing are authorized upon demonstration and proof of satisfactory tests to representative of the Commission or Bureau of Explosives. Leakers shall be rejected or repaired and retested.

13. Defective containers. (a) Leaks and other defects shall be repaired by welding, using welding material of the same composition as originally used by the manufacturer of the drum or other approved aluminum base alloy of equal corrosion and strength qualities.

Specification 42D

ALUMINUM DRUMS

1. Compliance. (a) Required in all details.

2. Rated capacity. (a) Rated capacity as marked, see para. 9 (a)(3). Not less than 4 gallons; actual capacity shall be rated capacity plus at least 2 per cent.

3. Composition. (a) Body and heads of aluminum at least 99 per cent pure, or an aluminum base alloy of equivalent corrosion resistance and physical properties.

4. Outage. (a) Two per cent of rated capacity; plus a maximum tolerance of 1 quart.

5. Seams. (a) Welded, including attachment of flanges for closures and other devices. Circumferential seams at least 3″ from top of chime; chime seams not permitted.

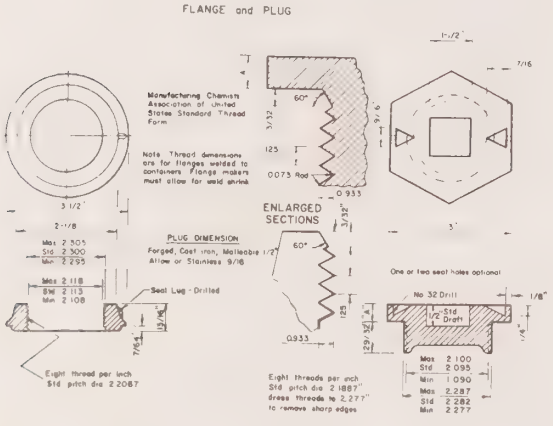
6. Parts and dimensions. (a) Parts and dimensions as follows:

Marked capacity not over (gallons)	Minimum thickness of material (inch)	Rolling hoops required, type authorized, and minimum dimensions	
		I-bar, size (inch)	U-type, aluminum, thickness (inch)
8½	0.093	¾ × 1¼	0.092
25	.102	¾ × 1¼	.128
46	.123	¾ × 1¼	.154
92	.154	1 × 1½	.....

(b) Rolling hoops must be firmly secured in place and not over 19 inches apart; beading under hoops not permitted. If welding is employed, the welding must be continuous on each edge of hoop.

7. Closures. (a) Of screw-thread type or secured by screw-thread device; openings over 2.3″ not authorized; suitable gaskets required. Vented closing devices of type approved by the Commission or Bureau of Explosives are authorized when specified by the purchaser.

(b) Threaded plugs, or caps, and flanges must be close fitting with gasket surfaces which bear squarely on each other when without gasket; they must have not over 8 threads per inch, with 5 complete threads engaged when gasket is in place, or not over 4 threads per inch, with 2 complete threads similarly engaged; two 5/16 inch drainage holes are authorized in flange. Thread form must conform to that shown by drawing below or be of a form that shall provide an equally efficient closure.



8. Projections. (a) Closing devices and other parts must not project beyond chime or rolling hoops.

9. Marking. (a) Marking on each container on top head by stamping with pressure dies, by embossing with raised marks, or plate attached by welding, as follows:

(1) CTC-42D. This mark shall be understood to certify that the container complies with all specification requirements.

(2) Name or symbol (letters) of maker; this must be registered with the Bureau of Explosives through the Commission and located just above, below, or following the mark specified in paragraph (a)(1) of this section.

(3) Gauge of metal, Brown and Sharpe or equivalent decimal thickness in inches, at start of fabrication; rated capacity in gallons; year of manufacture (for example, 7-25-50 or .1442-25-50).

10. Size of marking. (a) Size of marking (minimum): ½″ high for 25-gallon and smaller containers, ¾″ for over 25 and not over 46 gallons, and 1″ for over 46 gallons.

11. Type tests. (a) Samples, taken at random and closed as for use, shall withstand prescribed tests without leakage. Tests to be made of each type and size by each company starting production and to be repeated every four months. Samples last tested to be retained until further tests are made or for one year, whichever period is shorter. The type tests are as follows:

(1) Test by dropping, filled with water to 98 per cent capacity, from height of 4 feet on to solid concrete so as to strike diagonally on chime, or when without chime seam, to strike on other circumferential seam; also additional test on any other parts which might be considered weaker than the chime.

(2) Hydrostatic pressure test of 40 pounds per square inch sustained for 5 minutes.

12. Leakage test. (a) Each container shall be tested, with seams under water or covered with soapsuds or heavy oil, by interior air pressure of at least 10 pounds per square inch. Equally efficient means of testing are authorized upon demonstration and proof of satisfactory tests to representative of the Commission or Bureau of Explosives. Leakers shall be rejected or repaired and retested.

13. Defective containers. (a) Leaks and other defects shall be repaired by welding, using welding material of the same composition as originally used by the manufacturer of the drum or other approved aluminum base alloy of equal corrosion and strength qualities.

Specification 44B

MULTIWALL PAPER BAGS

1. Compliance. (a) Required in all details.

2. Paper. (a) Shipping sack kraft paper, plain, or extensible plain, shall conform to the average requirements specified in paragraph (a)(1) or (a)(2) of this section.

(1) Shipping sack, kraft paper, plain;[1]

Normal basis weight (500 sheets, 24″ × 36″)[2]	Minimum average dry tearing strength		Minimum average dry tensile strength per inch width	
	M.D.[3]	Total M.D. plus C.D.[3]	C.D.[3]	Total C.D. plus M.D.[3]
Pounds	Grams	Grams	Pounds	Pounds
40	88	188	14	41
50	110	235	19	53
60	132	282	23	64
70	154	329	27	74

[1]Shipping sack kraft paper, plain, is paper that consists of all sulphate pulp and no other fibre, and which has not been treated by colouring, bleaching,

creping, coating, spraying, laminating, or impregnating for special qualities. Paper shall have a degree of water resistance as secured by normal rosin sizing and shall comply with the requirements in paragraph (a) (1) of this section.

[2]A tolerance of minus 10 per cent of the basis weight of individual plies of plain shipping sack kraft paper will be permitted; an average tolerance of minus 5 per cent will be permitted in the sum total basis weight of all plies in multiwall constructions. Variations in excess of specified basis weights will not be considered a defect or deviation. The basis weight of paper means the basis weight as produced by the paper machine, not including finish subsequently applied, such as coating or printing.

[3]M.D. means machine direction. C.D. means cross direction.

(2) Shipping sack, extensible kraft paper, plain;[1]

Nominal basis weight (500 sheets, 24″ × 36″)[2]	Minimum dry tearing strength		Minimum tensile energy absorption ft./lbs. per square foot of paper	
	M.D.[4]	Total M.D. plus C.D.[3]	C.D.[3]	Total C.D. plus M.D.[3]
Pounds	Grams	Grams		
40	88	188	4.5	14.0
50	110	235	5.6	17.0
60	132	282	7.0	20.0
70	154	329	8.0	23.0
80	176	376	9.0	26.0

[1][2]Extensible shipping sack kraft paper, plain, is paper that consists of all sulphate pulp and no other fibre, and which has not been treated by colouring, bleaching, creping, coating, spraying, laminating, or impregnating for special qualities. Paper shall have a degree of water resistance as secured by normal rosin sizing, and shall comply with the requirements in paragraph (a) (2) of this section.

[2][3]A tolerance of minus 10 per cent of the basis weight of individual plies of extensible shipping sack kraft paper will be permitted; an average tolerance of minus 5 per cent will be permitted in the sum total basis weight of all plies in multiwall constructions. Variations in excess of specified basis weights will not be considered a defect or deviation. The basis weight of paper means the basis weight as produced by the paper machine, not including finish subsequently applied, such as coating or printing.

[3]M.D. means machine direction. C.D. means cross direction.

[4]Variations in cross-direction tensile energy absorption of not more than 0.5 units below the minimum requirements will be permitted, provided the variations are compensated by an increase in the machine-direction tearing strength in the ratio of twenty units of tearing strength to one unit of tensile energy absorption, and variations in total tensile energy absorption of not more than one unit below the minimum requirements will be permitted, provided the variations are compensated by an increase in the total tearing strength in the same ratio. Similarly, variations in machine-direction tearing strength of not more than ten units below minimum requirements will be permitted, provided variations are compensated by an increase in cross-direction tensile energy absorption in the ratio of one unit of tensile energy absorption to twenty units of tearing strength; and variations in total tearing strength of not more than twenty units below the minimum requirements will be permitted, provided the variations are compensated by an increase in the total tensil energy absorption in the same ratio. Conformance with the requirements of Table shall be established by comparing the sum of the basis weights and tests for all of the plies specified in the construction of the bag, with the sum of the specified basis weights and tests for the respective papers comprising the different plies. All requirements in this table are for a paper conditioned to a relative humidity of 50 per cent at a temperature of 23°C. (73°F).

(b) Asphalt laminated or polyethylene coated shipping sack kraft paper when used shall comply with the following requirements:

Type paper	Minimum average dry tearing strength		Minimum average dry tensile strength per inch width		Heat resistance hours at 150°F. without impairing function of sack	Maximum average water-vapour permeability from both sides at 50 per cent R.H. and 73°F. g/m 2/24 hours	
	M.D.	Total M.D. plus C.D.	Total C.D.	C.D. plus M.D.		Uncreased	Creased
Asphalt laminated[2][4]	Grams	Grams	Pounds	Pounds			
10PE-50 1/50-10PE[1]	110	235	19	53	5	9.0	15.0
15PE-50 1/50-15PE[1]	110	235	19	53	5	4.5	7.5

[1]Creasing at 40°F.

[2]Asphalt laminated kraft paper when used as a wall in fabricated sacks shall conform to the requirements of paragraph (b) of this section and shall consist of two sheets of kraft paper, the total basis weight of the two paper plies not less than 50 pounds per ream (500 sheets, 24″ × 36″), continuously and uniformly laminated together with an average of not less than 25 pounds of asphalt per ream (500 sheets, 24″ × 36″). Tolerance of minus 5 per cent will be allowed on individual components. The total basis weight of the finished combination shall not exceed 100 pounds per ream (500 sheets, 24″ × 36″). An asphalt laminated kraft wall meeting these requirements may be substituted for a plain kraft wall of 50 pounds basis or less, provided it meets the specification.

[1] Polyethylene-coated shipping sack kraft paper. The polyethylene-coated kraft paper when used as walls in fabricated sacks shall meet the heat resistance and water-vapor permeability requirements as specified in the table. A tolerance of minus 10 per cent will be allowed for the lot sample average coating weight of polyethylene on shipping sack kraft paper. Minimum samples for testing shall comprise not less than 3 speciemns 16 square inches each selected representatively from each polyethylene-coated wall of each sack in the lot sample. Where barrier sheets are based on extensible kraft the weight of the barrier material shall be in addition to the basis weight of the paper.

[4]Asphalt laminated extensible kraft paper must consist of two sheets of extensible kraft paper, the total basis weight of the paper in the finished combination being not less than 50 pounds per ream (24×36-500) with neither sheet weighing less than 23 pounds continuously and uniformly laminated together, with an average of not less than 25 pounds of asphalt per ream (24 × 36—500). In determining the basis weight and test conformance of bags containing an asphalt laminated extensible kraft wall, the asphalt laminated extensible kraft wall shall be treated as if it were a single extensible kraft wall or combination of walls of 10 pounds lower total paper basis weight than the sum of the nomimal basis weight in the asphalt laminated wall, but in no case shall be treated as less than the equivalent of a 50 pounds basis weight wall.

(c) Laminating materials. Any laminant other than asphalt or other water-vapour barrier walls may be used provided they meet the requirements in paragraph (b) of this section.

(d) All values in paragraphs (a) and (b) of this section are for paper having a moisture content in equilibrium with an atmosphere having a relative humidity of 50 per cent plus or minus 2 per cent at a temperature of 73°F. plus or minus 3.5F. following preconditioning of the test specimens to a moisture content between 3 and 5.5 per cent by exposure to relatively dry air having a temperature no greater than 140°F.

(e) Conformance of sacks with paper strength requirements shall be established by comparing the sums of the test values for all the walls of the new and unused sack with the sums of the respective strength values specified in paragraphs (a) and (b) of this section for the respective papers specified for the different walls of the sack by a method acceptable to the Commission or the Bureau of Explosives.

(1) Variation in cross direction dry tensile strength of not more than 2 units below the minimum requirement based on paragraphs (a) and (b) of this section will be permitted for each wall of the sack, provided the variation is compensated for by a machine direction tearing strength test value in excess of the minimum requirement obtained from the tables, in the ratio of 5 units of tearing strength for each unit of dry tensile strength test below the minimum requirement; and variation in combined dry tensile strength of not more than 4 units below the minimum requirements based on paragraphs (a) and (b) of this section will be permitted for each wall used provided the variation is compensated for

by a combined tearing strength test value in excess of the minimum requirement obtained from the tables in the ratio of 5 units of combined tearing strength for each unit of dry tensile strength test below the minimum requirement. Similarly, variation in machine direction tearing strength of not more than 10 units below the minimum requirement will be permitted for each wall, provided the variation is compensated for by a cross direction dry tensile strength test value in excess of the minimum requirement obtained from the tables in the ratio of 1 unit of dry tensile strength for each 5 units of tearing test below the minimum requirement: and variation in combined tearing strength of not more than 20 units below the minimum requirement obtained from the tables will per permitted for each wall provided the variation is compensated for by a combined dry tensile strength test value in excess of the minimum requirements obtained from the tables in ratio of 5 units of tearing strength for each unit of dry tensile strength below the minimum requirement.

3. Construction. (a) Bags must be at least 4 thicknesses of paper; this must be heavy duty shipping sack kraft paper, conforming to the requirements of paragraph 2, (a) and (b) or equivalent, with a minimum total basis weight of 200 pounds of paper (500 sheets, 24″ × 36″). Outer sheet must be of water resistant stock at least 60 pounds basis weight, inner sheets not less than 40 pounds basis weight. Bags to be of "satchel bottom" construction; bottoms to be reinforced with a kraft paper patch at least 30 pounds basis weight. Other bottoms of equal efficiency are authorized.

(b) Or, bags must be at least 3 thicknesses of paper: this must be heavy duty shipping sack kraft paper, or equivalent with a minimum total basis weight of 110 pounds (500 sheets, 24″ × 36″), fastened together with waterproof composition reinforced with jute, sisal, cotton, or other yarn or cord imbedded in the composition and crisscrossed at intervals of not over ½″, approximately, so as to give approximately the same tensile strength for both width and length. Bags to be of "satchel bottom" construction. Other bottoms of equal efficiency are authorized.

(c) Moistureproof barrier sheets of paper, if used, must meet the requirements of paragraph 2 (b) and shall be considered as one thickness of paper and shall be counted as 50 pounds basis weight (500 sheets, 24″ × 36″).

4. Adhesive. (a) Moisture resistant adhesive must be used on all seams, joints and bottom patch, if any.

5. Closure. (a) For 4-ply bags: Inner (fourth) ply to be diamond folded loose, the third ply to be diamond folded and silicated across all its overlapping folds; the two outer plied to be diamond folded, and cross sealed, front to back and side to side, with gummed tape extending at least 2 inches down sides of bag, sealing tape must be 4″ wide, of No. 1 Kraft paper, 90 pounds basis weight (500 sheets, 24″ × 36″), or equivalent, and having a Mullen or Cady test of not less than 90 per cent of basis weight. Other closures of equal efficiency are authorized.

(b) for all bags: Any closure for the top which is equal in efficiency to that of the bottom is authorized.

6. Tests for shipment. (a) Bags as prepared for shipment must be able to withstand four 4-foot drops, one on each end and one each on opposite sides, without sifting or rupture.

7. Marking. (a) Marking on each bag with letters and figures at least ½″ high in rectangle as follows:

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(1) This mark shall be understood to certify that bag complies with all specification requirements.

(2) Name and address of maker located just above or below the mark specified in paragraph (a) of this section; symbol (letters) authorized if registered with the Bureau of Explosives through the Commission.

Specification 44C

MULTIWALL PAPER BAGS

1. Compliance. (a) Required in all details.

2. Paper. (a) Shipping sack kraft paper, plain, or extensible plain, shall conform to the average requirements specified in paragraph (a)(1) or (a)(2) of this section.

(1) Shipping sack, kraft paper, plain;[1]

Normal basis weight (500 sheets, 24″ × 36″)[2]	Minimum average dry tearing strength		Minimum average dry tensile strength per inch width	
	M.D.[3]	Total M.D. plus C.D.[3]	C.D.[3]	Total C.D. plus M.D.[3]
Pounds	Grams	Grams	Pounds	Pounds
40	88	188	14	41
50	110	235	19	53
60	132	282	23	64
70	154	329	27	74

[1]Shipping sack kraft paper, plain, is paper that consists of all sulphate pulp and no other fibre, and which has not been treated by colouring, bleaching, creping, coating, spraying, laminating, or impregnating for special qualities. Paper shall have a degree of water resistance as secured by normal rosin sizing and shall comply with the requirements in paragraph (a) (1) of this section.

[2]A tolerance of minus 10 per cent of the basis weight of individual plies of plain shipping sack kraft paper will be permitted; an average tolerance of minuus 5 per cent will be permitted in the sum total basis weight of all plies in multiwall constructions. Variations in excess of specified basis weights will not be considered a defect or deviation. The basis weight of paper means the basis weight as produced by the paper machine, not including finish subsequently applied, such as coating or printing.

[3]M.D. means machine direction. C.D. means cross direction.

(2) Shipping sack, extensible kraft paper, plain;[1]

Nominal basis weight (500 sheets, 24″ × 36″)[2]	Minimum dry tearing strength		Minimum tensile energy absorption ft./lbs. per square foot of paper	
	M.D.[3]	Total M.D. plus C.D.[3]	C.D.[3]	Total C.D. plus M.D.[3,4]
Pounds	Grams	Grams		
40	88	188	4.5	14.0
50	110	235	5.6	17.0
60	132	282	7.0	20.0
70	154	329	8.0	23.0
80	176	376	9.0	26.0

[1]Extensible shipping sack kraft paper, plain, is paper that consists of all sulphate pulp and no other fibre, and which has not been treated by colouring, bleaching, creping, coating, spraying, laminating, or impregnating for special qualities. Paper shall have a degree of water resistance as secured by normal rosin sizing, and shall comply with the requirements in paragraph (a) (2) of this section.

[2]A tolerance of minus 10 per cent of the basis weight of individual plies of extensible shipping sack kraft paper will be permitted; an average tolerance of minus 5 per cent will be permitted in the sum total basis weight of all plies in multiwall constructions. Variations in excess of specified basis weights will not be considered a defect or deviation. The basis weight of paper means the basis weight as produced by the paper machine, not including finish subsequently applied, such as coating or printing.

[3]M.D. means machine direction. C.D. means cross direction.

[4]Variations in cross-direction tensile energy absorption of not more than 0.5 units below the minimum requirements will be permitted, provided the variations are compensated by an increase in the machine-direction tearing strength in the ratio of twenty units of tearing strength to one unit of tensile energy absorption, and variations in total tensile energy absorption of not more than one unit below the minimum requirements will be permitted, provided the variations are compensated by an increase in the total tearing strength in the same ratio. Similarly, variations in machine-direction tearing strength of not more than ten units below minimum requirements will be permitted, provided variations are compensated by an increase in cross-direction tensile energy absorption in the ratio of one unit of tensile energy absorption to twenty units of tearing strength; and variations in total tearing strength of not more than twenty units below the minimum requirements will be permitted, provided the variations are compensated by an increase in the total tensil energy absorption in the same ratio. Conformance with the requirements of Table shall be established by comparing the sum of the basis weights and tests for all of the plies specified in the construction of the bag, with the sum of the specified basis weights and tests for the respective papers comprising the different plies. All requirements in this table are for a paper conditioned to a relative humidity of 50 per cent at a temperature of 23°C. (73°F).

(b) Asphalt laminated or polyethylene coated shipping sack kraft paper when used shall comply with the following requirements:

Type paper	Minimum average dry tearing strength		Minimum average dry tensile strength per inch width		Heat resistance hours at 150°F. without impairing function of sack	Maximum average water-vapour permeability from both sides at 50 per cent R.H. and 73°F. g/m 2/24 hours	
	M.D.	Total M.D. plus C.D.	C.D.	Total C.D. plus M.D.		Uncreased	Creased[1]
Asphalt laminated[2,4]	Grams 110	Grams 235	Pounds 19	Pounds 53	5	9.0	15.0
10PE-50 1/50-10PE[1]	110	235	19	53	5	7.0	12.0
15PE-50 1/50-15PE[1]	110	235	19	53	5	4.5	7.5

[1]Creasing at 40°F.

[2]Asphalt laminated kraft paper when used as a wall in fabricated sacks shall conform to the requirements of paragraph (b) of this section and shall consist of two sheets of kraft paper, the total basis weight of the two paper plies not less than 50 pounds per ream (500 sheets, 24″ × 36″), continuously and uniformly laminated together with an average of not less than 25 pounds of asphalt per ream (500 sheets, 24″ × 36″). Tolerance of minus 5 per cent will be allowed on individual components. The total basis weight of the finished combination shall not exceed 100 pounds per ream (500 sheets, 24″ × 36″). An asphalt laminated kraft wall meeting these requirements may be substituted for a plain kraft wall of 50 pounds basis or less, provided it meets the specification.

[3] Polyethylene-coated shipping sack kraft paper. The polyethylene-coated kraft paper when used as walls in fabricated sacks shall meet the heat resistance and water-vapor permeability requirements as specified in the table. A tolerance of minus 10 per cent will be allowed for the lot sample average coating weight of polyethylene on shipping sack kraft paper. Minimum samples for testing shall comprise not less than 3 specimens 16 square inches each selected representatively from each polyethylene-coated wall of each sack in the lot sample. Where barrier sheets are based on extensible kraft the weight of the barrier material shall be in addition to the basis weight of the paper.

[4]Asphalt laminated extensible kraft paper must consist of two sheets of extensible kraft paper, the total basis weight of the paper in the finished combination being not less than 50 pounds per ream (24×36-500) with neither sheet weighing less than 23 pounds continuously and uniformly laminated together, with an average of not less than 25 pounds of asphalt per ream (24 × 36—500). In determining the basis weight and test conformance of bags containing an asphalt laminated extensible kraft wall, the asphalt laminated extensible kraft wall shall be treated as if it were a single extensible kraft wall or combination of walls of 10 pounds lower total paper basis weight than the sum of the nominal basis weight in the asphalt laminated wall, but in no case shall be treated as less than the equivalent of a 50 pounds basis weight wall.

(c) Laminating materials. Any laminant other than asphalt or other water-vapour barrier walls may be used provided they meet the requirements in paragraph (b) of this section.

(d) All values in paragraphs (a) and (b) of this section are for paper having a moisture content in equilibrium with an atmosphere having a relative humidity of 50 per cent plus or minus 2 per cent at a temperature of 73°F. plus or minus 3.5F. following preconditioning of the test specimens to a moisture content between 3 and 5.5 per cent by exposure to relatively dry air having a temperature no greater than 140°F.

(e) Conformance of sacks with paper strength requirements shall be established by comparing the sums of the test values for all the walls of the new and unused sack with the sums of the respective strength values specified in paragraphs (a) and (b) of this section for the respective papers specified for the different walls of the sack by a method acceptable to the Commission or the Bureau of Explosives.

(1) Variation in cross direction dry tensile strength of not more than 2 units below the minimum requirement based on paragraphs (a) and (b) of this section will be permitted for each wall of the sack, provided the variation is compensated for by a machine direction tearing strength test value in excess of the minimum requirement obtained from the tables, in the ratio of 5 units of tearing strength for each unit of dry tensile strength test below the minimum requirement; and variation in combined dry tensile strength of not more than 4 units below the minimum requirement based on paragraphs (a) and (b) of this section will be permitted for each wall used provided the variation is compensated for by a combined tearing strength test value in excess of the minimum requirement obtained form the tables in the ration of 5 units of combined tearing strength for each unit of dry tensile strength test below the minimum requirement. Similarly variation in machine direction tearing strength of not more than 10 units below the minimum requirement will be permitted for each wall, provided the variation is compensated for by a cross direction dry tensile strength test value in excess of the minimum requirement obtained from the tables in the ratio of 1 unit of dry tensile strength for each 5 units of tearing strength test below the minimum requirement; and variation in combined tearing strength of not more than 20 units below the minimum requirement obtained from the tables will be permitted for each wall provided the variation is compensated for by a combined dry tensile strength test value in excess of the minimum requirement obtained from the tables in the ratio of 5 units of tearing strength for each unit of dry tensile strength below the minimum requirement.

3. Construction. (a) Bags must be at least 4 thicknesses of paper; this must be heavy duty shipping sack kraft paper conforming to the requirements of paragraph 2, (a) and (b), or equivalent, with a minimum total basis weight of 250 pounds of paper (500 sheets, 24″ × 36″). Outer sheet must be of water resistant stock and at least 60 pounds basis weight, inner sheets not less than 40 pounds basis weight. Bags to be of sewn, sift-proof bottom construction. Other bottoms of equal efficiency authorized.

(b) Moistureproof barrier sheets of paper, if used, must meet the requirements of paragraph 2 (b) and shall be considered as one thickness of paper and shall be counted as 50 pounds basis weight (500 sheets, 24″ × 36″).

4. Adhesive. (a) Moisture resistant adhesive must be used on all seams, joints and bottom patch, if any.

5. Closure. (a) For all bags: Any closure for the top which is equal in efficiency to that of the bottom, is authorized.

6. Tests for shipment. (a) Bags as prepared for shipment must be able to withstand four 4-foot drops, one on each end and one each on opposite sides, without sifting or rupture.

7. Marking. (a) On each bag with letters and figures at least 1/2″ high in rectangle as follows:

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(1) This mark shall be understood to certify that bag complies with all specification requirements.

(2) Name and address of maker located just above or below the mark specified in paragraph (a) of this section; symbol (letters) authorized if registered with the Bureau of Explosives through the Commission.

Specification 44D

MULTIWALL PAPER BAGS

1. Compliance. (a) Required in all details.

2. Paper. (a) Shipping sack kraft paper, plain, or extensible plain, shall conform to the average requirements specified in paragraphs (a)(1) and (a)(2) of this paragraph.

(1) Shipping sack, kraft paper, plain;[1]

Normal basis weight (500 sheets, 24″ × 36″)[2,4]	Minimum average dry tearing strength		Minimum average dry tensile strength per inch width	
	M.D.[3]	Total M.D. plus C.D.[3]	C.D.[3]	Total C.D. plus M.D.[3]
Pounds	Grams	Grams	Pounds	Pounds
40	88	188	14	41
50	110	235	19	53
60	132	282	23	64
70	154	329	27	74

[1]Shipping sack kraft paper, plain, is paper that consists of all sulphate pulp and no other fibre, and which has not been treated by colouring, bleaching, creping, coating, spraying, laminating, or impregnating for special qualities. Paper shall have a degree of water resistance as secured by normal rosin sizing and shall comply with the requirements in paragraph (a) (1) of this section.

[2]A tolerance of minus 10 per cent of the basis weight of individual plies of plain shipping sack kraft paper will be permitted; an average tolerance of minus 5 per cent will be permitted in the sum total basis weight of all plies in multiwall constructions. Variations in excess of specified basis weights will not be considered a defect or deviation. The basis weight of paper means the basis weight as produced by the paper machine, not including finish subsequently applied, such as coating or printing.

[3]M.D. means machine direction. C.D. means cross direction.

[4]A bleached sulphate kraft outer wall of 70 pounds basis weight will be permitted provided the combined test values of all of the 5 walls of the completed multiwall sack are in conformance with paragraph (c) of this section and section 3.

(2) Shipping sack, extensible kraft paper, plain;[1]

Nominal basis weight (500 sheets, 24″ × 36″)[2]	Minimum dry tearing strength		Minimum tensile energy absorption ft./lbs. per square foot of paper	
	M.D.[3]	Total M.D. plus C.D.[3,4]	C.D.[3,4]	Total C.D. plus M.D.[3,4]
Pounds	Grams	Grams		
40	88	188	4.5	14.0
50	110	235	5.6	17.0
60	132	282	7.0	20.0
70	154	329	8.0	23.0
80	176	376	9.0	26.0

[1]Extensible shipping sack kraft paper, plain, is paper that consists of all sulphate pulp and no other fibre, and which has not been treated by colouring, bleaching, creping, coating, spraying, laminating, or impregnating for special qualities. Paper shall have a degree of water resistance as secured by normal rosin sizing, and shall comply with the requirements in paragraph (a) (2) of this section.

[2]A tolerance of minus 10 per cent of the basis weight of individual plies of extensible shipping sack kraft paper will be permitted; an average tolerance of minus 5 per cent will be permitted in the sum total basis weight of all plies in multiwall constructions. Variations in excess of specified basis weights will not be considered a defect or deviation. The basis weight of paper means the basis weight as produced by the paper machine, not including finish subsequently applied, such as coating or printing.

[3]M.D. means machine direction. C.D. means cross direction.

[4]Variations in cross-direction tensile energy absorption of not more than 0.5 units below the minimum requirements will be permitted, provided the variations are compensated by an increase in the machine-direction tearing strength in the ratio of twenty units of tearing strength to one unit of tensile energy absorption, and variations in total tensile energy absorption of not more than one unit below the minimum requirements will be permitted, provided the variations are compensated by an increase in the total tearing strength in the same ratio. Similarly, variations in machine-direction tearing strength of not more than ten units below minimum requirements will be permitted, provided variations are compensated by an increase in cross-direction tensile energy absorption in the ratio of one unit of tensile energy absorption to twenty units of tearing strength; and variations in total tearing strength of not more than twenty units below the minimum requirements will be permitted, provided the variations are compensated by an increase in the total tensil energy absorption in the same ratio. Conformance with the requirements of Table shall be established by comparing the sum of the basis weights and tests for all of the plies specified in the construction of the bag, with the sum of the specified basis weights and tests for the respective papers comprising the different plies. All requirements in this table are for a paper conditioned to a relative humidity of 50 per cent at a temperature of 23°C. (73°F).

(b) Asphalt laminated or polyethylene coated shipping sack kraft paper when used shall comply with the following requirements:

Type paper	Minimum average dry tearing strength		Minimum average dry tensile strength per inch width		Heat resistance hours at 150°F. without impairing function of sack	Maximum average water-vapour permeability from both sides at 50 per cent R.H. and 73°F. g/m 2/24 hours	
	M.D.	Total M.D. plus C.D.	C.D.	Total C.D. plus M.D.		Uncreased	Creased[1]
Asphalt laminated[2,4]	Grams 110	Grams 235	Pounds 19	Pounds 53	5	9.0	15.0

10PE-50 1/50-10PE[3]	110	235	19	53	5	7.0	12.0
15PE-50 1/50-15PE[3]	110	235	19	53	5	4.5	7.5

[1]Creasing at 40°F.

[2]Asphalt laminated kraft paper when used as a wall in fabricated sacks shall conform to the requirements of paragraph (b) of this section and shall consist of two sheets of kraft paper, the total basis weight of the two paper plies not less than 50 pounds per ream (500 sheets, 24″ × 36″), continuously and uniformly laminated together with an average of not less than 25 pounds of asphalt per ream (500 sheets, 24″ × 36″). Tolerance of minus 5 per cent will be allowed on individual components. The total basis weight of the finished combination shall not exceed 100 pounds per ream (500 sheets, 24″ × 36″). An asphalt laminated kraft wall meeting these requirements may be substituted for a plain kraft wall of 50 pounds basis or less, provided it meets the specification.

[3] Polyethylene-coated shipping sack kraft paper. The polyethylene-coated kraft paper when used as walls in fabricated sacks shall meet the heat resistance and water-vapor permeability requirements as specified in the table. A tolerance of minus 10 per cent will be allowed for the lot sample average coating weight of polyethylene on shipping sack kraft paper. Minimum samples for testing shall comprise not less than 3 specimens 16 square inches each selected representatively from each polyethylene-coated wall of each sack in the lot sample. Where barrier sheets are based on extensible kraft the weight of the barrier material shall be in addition to the basis weight of the paper.

[4]Asphalt laminated extensible kraft paper must consist of two sheets of extensible kraft paper, the total basis weight of the paper in the finished combination being not less than 50 pounds per ream (24×36-500) with neither sheet weighing less than 23 pounds continuously and uniformly laminated together, with an average of not less than 25 pounds of asphalt per ream (24 × 36–500). In determining the basis weight and test conformance of bags containing an asphalt laminated extensible kraft wall, the asphalt laminated extensible kraft wall shall be treated as if it were a single extensible kraft wall or combination of walls of 10 pounds lower total paper basis weight than the sum of the nominal basis weight in the asphalt laminated wall, but in no case shall be treated as less than the equivalent of a 50 pounds basis weight wall

(c) Laminating materials. Any laminant other than asphalt or other water-vapour barrier walls may be used provided they meet the requirements in paragraph (b) of this section.

(d) All values in paragraphs (a) and (b) of this section are for paper having a moisture content in equilibrium with an atmosphere having a relative humidity of 50 per cent plus or minus 2 per cent at a temperature of 73°F. plus or minus 3.5F. following preconditioning of the test specimens to a moisture content between 3 and 5.5 per cent by exposure to relatively dry air having a temperature no greater than 140°F.

(e) Conformance of sacks with paper strength requirements shall be established by comparing the sums of the test values for all the walls of the new and unused sack with the sums of the respective strength values specified in paragraphs (a) and (b) of this section for the respective papers specified for the different walls of the sack by a method acceptable to the Commission or the Bureau of Explosives.

(1) Variation in cross direction dry tensile strength of not more than 2 units below the minimum requirement based on paragraphs (a) and (b) of this section will be permitted for each wall of the sack, provided the variation is compensated for by a machine direction tearing strength test value in excess of the minimum requirement obtained from the tables, in the ratio of 5 units of tearing strength for each unit of dry tensile strength test below the minimum requirement; and variation in combined dry tensile strength of not more than 4 units below the minimum requirement based on paragraphs (a) and (b) of this section will be permitted for each wall used provided the variation is compensated for by a combined tearing strength test value in excess of the minimum requirement obtained from the tables in the ratio of 5 units of combined tearing strength for each unit of dry tensile strength test below the minimum requirement. Similarly, variation in machine direction tearing strength of not more than 10 units below the minimum requirement will be permitted for each wall, provided the variation is compensated for by a cross direction dry tensil strength test value in excess of the minimum requirement obtained from the tables in the ratio of 1 unit of dry tensile strength for each 5 units of tearing strength test below the minimum requirement; and variation in combined tearing strength of not more than 20 units below the minimum requirement obtained from the tables will be permitted for each wall provided the variation is compensated for by a combined dry tensile strength test value in excess of the minimum requirement obtained from the tables in the ratio of 5 units of tearing strength for each unit of dry tensile strength below the minimum requirement.

3. Construction. (a) Bags must be at least 5 thicknesses of paper; this must be heavy duty shipping sack kraft paper, conforming to the requirements of paragraph 2, (a) and (b), or equivalent, with a minimum total basis weight of 320 pounds of paper (500 sheets, 24″ × 36″). Outer sheet must be of water resistant stock and at least 70 pounds basis weight, inner sheets not less than 50 pounds basis weight. Bags to be of sewn, sift-proof bottom construction. Other bottoms of equal efficiency authorized.

NOTE 1: Exceptions to these construction requirements are authorized in §§ 73.367 (a) (5) and 73.377(i).

(b) Moistureproof barrier sheets of paper, if used, must meet the strength requirements of § 2 (b) and shall be counted as 50 pounds basis weight (500 sheets, 24″ × 36″).

4. Adhesive. (a) Moisture resistant adhesive must be used on all seams, joints and bottom patch, if any.

5. Closure. (a) For all bags: Any closure for the top which is equal in efficiency to that of the bottom, is authorized.

6. Tests for shipment. (a) Bags as prepared for shipment must be able to withstand four 4-foot drops, one on each end and one each on opposite sides, without sifting or rupture.

7. Marking. (a) Marking each bag with letters and figures at least ½″ high in rectangle as follows:

CTC-44D

(1) This mark shall be understood to certify bag complies with all specification requirements.

(2) Name and address of maker located just above or below the mark specified in paragraph (a) of this section; symbol (letters) authorized if registered with the Bureau of Explosives through the Commission.

Specification 44E

MULTIWALL PAPER BAGS

1. Compliance. (a) Required in all details.

2. Paper. (a) Shipping sack kraft paper, plain, or extensible plain, shall conform to the average requirements specified in paragraph (a)(1) or (a)(2) of this section.

(1) Shipping sack, kraft paper, plain;[1]

Normal basis weight (500 sheets, 24″ × 36″)[2,4]	Minimum average dry tearing strength		Minimum average dry tensile strength per inch width	
	M.D.[3]	Total M.D. plus C.D.[3]	C.D.[3]	Total C.D. plus M.D.[3]
Pounds	Grams	Grams	Pounds	Pounds
40	88	188	14	41
50	110	235	19	53
60	132	282	23	64
70	154	329	27	74

[1]Shipping sack kraft paper, plain, is paper that consists of all sulphate pulp and no other fibre, and which has not been treated by colouring, bleaching (except as provided by footnote 4 of this table), creping, coating, spraying, laminating, or impregnating for special qualities. Paper shall have a degree of water resistance as secured by normal rosin sizing and shall comply with the requirements in paragraph (a) (1) of this section.

[2]A tolerance of minus 10 per cent of the basis weight of individual plies of plain shipping sack kraft paper will be permitted; an average tolerance of minus 5 per cent will be permitted in the sum total basis weight of all plies in multiwall constructions. Variations in excess of specified basis weights will not be considered a defect or deviation. The basis weight of paper means the basis weight as produced by the paper machine, not including finish subsequently applied, such as coating or printing.

[3]M.D. means machine direction. C.D. means cross direction.

[4]A bleached sulphate kraft outer sheet of not less than 50 pounds basis weight is authorized providing the combined test values of all of the sheets of the bag are in conformance with paragraph (e) of this section and section 3.

(2) Shipping sack, extensible kraft paper, plain;[1]

Nominal basis weight (500 sheets, 24″ × 36″)[2,4]	Minimum dry tearing strength		Minimum tensile energy absorption ft./lbs. per square foot of paper	
	M.D.[3]	Total M.D. plus C.D.[3]	C.D.[3]	Total C.D. plus M.D.[3]
Pounds	Grams	Grams		
40	88	188	4.5	14.0
50	110	235	5.6	17.0
60	132	282	7.0	20.0
70	154	329	8.0	23.0
80	176	376	9.0	26.0

Extensible shipping sack kraft paper, plain, is paper that consists of all sulphate pulp and no other fibre, and which has not been treated by colouring, bleaching (except as provided by footnote 4 of this table), creping, coating, spraying, laminating, or impregnating for special qualities. Paper shall have a degree of water resistance as secured by normal rosin sizing, and shall comply with the requirements in paragraph (a) (2) of this section.

[2]A tolerance of minus 10 per cent of the basis weight of individual plies of plain shipping sack kraft paper will be permitted; an average tolerance of minus 5 per cent will be permitted in the sum total basis weight of all plies in multiwall constructions. Variations in excess of specified basis weights will not be considered a defect or deviation. The basis weight of paper means the basis weight as produced by the paper machine, not including finish subsequently applied, such as coating or printing.

[3]M.D. means machine direction. C.D. means cross direction.

[4]A bleached sulphate extensible kraft outer sheet of not less than 50 pounds basis weight is authorized providing the combined test values of all the sheets of the bag are in conformance with paragraph (e) of this section and section 3.

[5]Variations in cross-direction tensile energy absorption of not more than 0.5 units below the minimum requirements will be permitted, provided the variations are compensated by an increase in the machine-direction tearing strength in the ratio of twenty units of tearing strength to one unit of tensile energy absorption, and variations in total tensile energy absorption of not more than one unit below the minimum requirements will be permitted, provided the variations are compensated by an increase in the total tearing strength in the same ratio. Similarly, variations in machine-direction tearing strength of not more than ten units below minimum requirements will be permitted, provided variations are compensated by an increase in cross-direction tensile energy absorption in the ratio of one unit of tensile energy absorption to twenty units of tearing strength; and variations in total tearing strength of not more than twenty units below the minimum requirements will be permitted, provided the variations are compensated by an increase in the total tensil energy absorption in the same ratio. Conformance with the requirements of Table shall be established by comparing the sum of the basis weights and tests for all of the plies specified in the construction of the bag, with the sum of the specified basis weights and tests for the respective papers comprising the different plies. All requirements in this table are for a paper conditioned to a relative humidity of 50 per cent at a temperature of 23°C. (73°F).

(b) Asphalt laminated or polyethylene coated shipping sack kraft paper when used shall comply with the following requirements:

Type paper	Minimum average dry tearing strength		Minimum average dry tensile strength per inch width		Heat resistance hours at 150°F. without impairing function of sack	Maximum average water-vapour permeability from both sides[5] at 50 per cent R.H. and 73°F. g/m 2/24 hours	
	M.D.	Total M.D. plus C.D.	C.D.	Total C.D. plus M.D.		Uncreased	Creased[1]
Asphalt laminated[2,4]	Grams 110	Grams 235	Pounds 19	Pounds 53	5	9.0	15.0
10PE-50 1/50-10PE[3]	110	235	19	53	5	7.0	12.0
15PE-50 1/50-15PE[3]	110	235	19	53	5	4.5	7.5

[1]Creasing at 40°F.

[2]Asphalt laminated kraft paper when used as a wall in fabricated sacks shall conform to the requirements of paragraph (b) of this section and shall consist of two sheets of kraft paper, the total basis weight of the two paper plies not less than 50 pounds per ream (500 sheets, 24″ × 36″), continuously and uniformly laminated together with an average of not less than 25 pounds of asphalt per ream (500 sheets, 24″ × 36″). Tolerance of minus 5 per cent will be allowed on individual components. The total basis weight of the finished combination shall not exceed 100 pounds per ream (500 sheets, 24″ × 36″). An asphalt laminated kraft wall meeting these requirements may be substituted for a plain kraft wall of 50 pounds basis or less, provided it meets the specification.

[3] Polyethylene-coated shipping sack kraft paper. The polyethylene-coated kraft paper when used as walls in fabricated sacks shall meet the heat resistance and water-vapor permeability requirements as specified in the table. A tolerance of minus 10 per cent will be allowed for the lot sample average coating weight of polyethylene on shipping sack kraft paper. Minimum samples for testing shall comprise not less than 3 specimens 16 square inches each selected representatively from each polyethylene-coated wall of each sack in the lot sample. Where barrier sheets are based on extensible kraft the weight of the barrier material shall be in addition to the basis weight of the paper.

[4]Asphalt laminated extensible kraft paper must consist of two sheets of extensible kraft paper, the total basis weight of the paper in the finished combination being not less than 50 pounds per ream (24×36-500) with neither sheet weighing less than 23 pounds continuously and uniformly laminated together, with an average of not less than 25 pounds of asphalt per ream (24 × 36—500). In determining the basis weight and test conformance of bags containing an asphalt laminated extensible kraft wall, the asphalt laminated extensible kraft wall shall be treated as if it were a single extensible kraft wall or combination of walls of 10 pounds lower total paper basis weight than the sum of the nominal basis weight in the asphalt laminated wall, but in no case shall be treated as less than the equivalent of a 50 pounds basis weight wall.

(c) **Laminating materials.** Any laminant other than asphalt or other water-vapour barrier walls may be used provided they meet the requirements in paragraph (b) of this section.

(d) All values in paragraphs (a) and (b) of this section are for paper having a moisture content in equilibrium with an atmosphere having a relative humidity of 50 per cent plus or minus 2 per cent at a temperature of 73°F. plus or minus 3.5F. following preconditioning of the test specimens to a moisture content between 3 and 5.5 per cent by exposure to relatively dry air having a temperature no greater than 140°F.

(e) Conformance of sacks with paper strength requirements shall be established by comparing the sums of the test values for all the walls of the new and unused sack with the sums of the respective strength values specified in paragraphs (a) and (b) of this section for the respective papers specified for the different walls of the sack by a method acceptable to the Commission or the Bureau of Explosives.

(1) Variation in cross direction dry tensile strength of not more than 2 units below the minimum requirement based on paragraphs (a) and (b) of this section will be permitted for each wall of the sack, provided the variation is compensated for by a machine direction tearing strength test value in excess of the minimum requirement obtained from the tables, in the ratio of 5 units of tearing strength for each unit of dry tensile strength test below the minimum requirement; and variation in combined dry tensile strength of not more than 4 units below the minimum requirement based on paragraphs (a) and (b) of this section will be permitted for each wall used provided the variation is compensated for by a combined tearing strength test value in excess of the minimum requirement obtained form the tables in the ratio of 5 units of combined tearing strength for each unit of dry tensile strength test below the minimum requirement. Similarly variation in machine direction tearing strength of not more than 10 units below the minimum requirement will be permitted for each wall, provided the variation is compensated for by a cross direction dry tensile strength test value in excess of the minimum requirement obtained from the tables in the ratio of 1 unit of dry tensile strength for each 5 units of tearing strength test below the minimum requirement; and variation in combined tearing strength of not more than 20 units below the minimum requirement obtained from the tables will be permitted for each wall provided the variation is compensated for by a combined dry tensile strength test value in excess of the minimum requirement obtained from the tables in the ratio of 5 units of tearing strength for each unit of dry tensile strength below the minimum requirement.

3. Construction and capacity. (a) Bags must be at least 3 thicknesses of paper; this must be heavy duty shipping sack kraft paper conforming to the requirements of paragraph 2, (a) and (b), or equivalent, with a minimum total basis weight of 130 pounds of paper (500 sheets, 24″ × 36″). Outer sheet must be of water resistant stock and at least 50 pounds basis weight, inner sheets not less than 40 pounds basis weight. Bags to be of sewn and taped, cemented, taped, satchel bottom or other construction of equal efficiency to form a sift-proof and reasonably airtight container. Authorized for not over 50 pounds net weight, except that bags having a minimum total basis weight of 160 pounds of paper (500 sheets, 24″ × 36″) with outher sheet of water resistant stock and at least 60 pounds basis weight inner sheets not less than 50 pounds basis weight, are authorized for not to exceed 100 pounds net weight of contents.

(b) Moistureproof barrier sheets of paper, if used, must meet the requirements of paragraph 2 (b) and shall be considered as one thickness of paper and shall be counted as 50 pounds basis weight (500 sheets, 24″ × 36″).

4. Adhesive. (a) Moisture resistant adhesive must be used on all seams, joints and bottom patch, if any.

5. Closure. (a) For all bags: Any closure for the top which is equal in efficiency to that of the bottom, is authorized.

6. Tests for shipment. (a) Bags as prepared for shipment must be able to withstand four 4-foot drops, one on each end and one each on opposite sides, without sifting or rupture.

7. Marking. (a) Marking each bag with letters and figures at least 1/2″ high in rectangle as follows:

CTC-44E

(1) This mark shall be understood to certify bag complies with all specification requirements.

(2) Name and address of maker located just above or below the mark specified in paragraph (a) of this section; symbol (letters) authorized if registered with the Bureau of Explosives through the Commission.

Specification 44P

ALL-PLASTIC BAGS

1. Compliance. (a) Required in all details.

2. Plastic. (a) Plastic film shall be low density polyethylene having a melt index of 0.6 maximum, conforming to the minimum requirements specified in subparagraph (a)(1) of this section.

(1) Plastic film:

Nominal gauge (mils)[1]	Drop dart (grams)[2]	Pounds per sq. inch tensile[3]	Per cent elongation[3]	Tear (grams)[4]
5	210	2100	350	200
6	250	2100	350	240
7	295	2100	350	280
8	340	2100	350	350

Gauge as measured by ASTM D 374-57T; tolerance 10 per cent.

[2] Drop dart as measured by the drop dart method (ASTM D 1709-62T Method B). Under this method a polished steel dart having a diameter of 2 inches in the hemispherical head is suspended by an electro-magnet at a height sufficient to provide a drop of 60 inches to the surface of the test specimen. The test specimen must be placed over the bottom part of two-piece annular clamp having an inside diameter of 5 inches, so as to be uniformly flat and free of folds. Test specimen must cover the clamp at all points. Not less than 10 specimens, not more than one drop per specimen, must be tested. If one-half or more of the specimens tested resist failure the film shall be deemed to meet the requirements. Failure is defined as any break through the film

[3] Tensile and per cent elongation as measured by ASTM D 882-61T Method A.

[4] Tear as measured by ASTM D 1922-61T.

3. Construction and capacity. (a) Bags must be constructed of plastic film conforming to the requirements of § 78.241-2. Bags having heat-sealed ends must be capable of withstanding static loads of 1¼ pounds per mil per inch of seal as measured in the following manner. Three one-inch wide samples must be cut from the top seal and three one-inch wide samples must be cut from the bottom seal of each bag to be tested. Samples must be cut perpendicular to the seal, one from the centre of the seal and one each approximately 4 inches in each direction from the centre of the seal. (The preferred method of cutting the samples is to place a one-inch wide die on the flat bag so that both film layers and the seal area can be cut simultaneously.) Samples must be cut of sufficient length to permit wrapping each film end around a ¼-inch diameter metal rod and to permit clamping each end one inch from heat seal. Clamp used (such as a laboratory tubing clamp) must be one that will exert even pressure across a one-inch wide strip. Clamps must be carefully positioned on strips parallel to the heat seals. One clamp must be mounted to a support, permitting the sample strip to hang vertically, and a weight must be attached to the other clamp hanging free at the lower end of the assembly. The total weight exerted on the seal must be 1¼ pounds for each mil of gauge of the film. The test must be conducted at room temperature (approximately 73°F.). All samples tested must resist failure. Failure is defined as total seal separation occurring within 10 minutes after the test has begun. Other end closures of equal efficiency authorized. Bags of not less than 5 mil construction authorized for contents not to exceed 51 pounds net weight. Bags of not less than 7 mil construction authorized for contents not to exceed 81 pounds net weight.

4. Tests for shipment. (a) Bags as prepared for shipment must be able to withstand six drops from a height of 4 feet onto a solid surface, one drop on each end, one drop on each face, and one drop on each side (edge), without sifting or rupture.

5. Marking. (a) On each bag with letters and figures at least ½ inch high in rectangle as follows:

CTC-44P

(1) This mark shall be understood to certify bag complies with all specification requirements.

(2) Name and address of maker located just above or below the mark specified in paragraph (a) of this section; symbol (letters) authorized if registered with the Bureau of Explosives through the Commission.

Specification 45B
BAGS—CLOTH OR PAPER—LINED

1. Compliance. (a) Required in all details.

2. Capacity. (a) Not over 100 pounds net.

3. Assembly. (a) Bags shall consist of cloth and paper parts all cemented together with curing rubber latex or asphalt, thus making a waterproofed bag as follows:

(1) Inside lining sheet.

(2) Cloth sheet.

(3) Intermediate sheet.

(4) Outside paper sheet.

4. Inside lining sheet and intermediate sheet. (a) Inside lining sheet and intermediate sheet must be regenerated cellulose film at least 0.0012 inch thick or polyvinyl alcohol film at least 0.001 inch thick or other material of equal thickness and equivalent efficiency.

5. Cloth sheet. (a) Cloth sheet must be burlap at least 8-ounce, 40-inch Calcutta A or B mill grade or Osnaburg cotton cloth, at least 8½ ounces per square yard.

6. Paper. (a) Paper must be shipping sack Kraft, creped, at least 45 pounds per ream (500 sheets 24″ × 36″) before creping.

7. Latex and asphalt. (a) Latex and asphalt must be in sufficient quantity to form a secure bond between the parts of the bags.

8. Seams. (a) Seams must be dust-tight and made by cementing or by sewing and taping with impregnated cloth tape to give seam strength at least equal to that of bag material and prevent sifting.

9. Test. (a) The finished container, filled and closed as for shipment, must be capable of withstanding 2 drop tests of 6 feet on the butt and 2 drop tests of 6 feet on the side without sifting or rupture of burlap or liner.

10. Marking. (a) Marking on each container by marks at least 1 inch high as follows:

(1) CTC-45B; this mark shall be understood to certify that the container complies with all specification requirements.

(2) Name and address of maker; located above or below the mark specified in paragraph (a) (1) of this section; symbol (letters) authorized if registered with the Bureau of Explosives through the Canadian Transport Commission.

11. Closing for shipment. (a) By sewing and taping with impregnated cloth tape to give seam strength at least equal to that of bag material and prevent sifting.

Specification 51

STEEL PORTABLE TANKS

1. Requirements for design and construction. (a) Tanks must be of seamless or welded steel construction or combination of both and must have in excess of 1,000 pounds water capacity. Fusion welded tanks must be postweld heat treated and radiographed to provide the highest joint efficiency provided by the ASME Code. Tanks must be designed and constructed in accordance with and fulfill the requirements of the ASME Code. Tanks constructed in accordance with the requirements of Part UHT of the ASME Code must comply with the following additional requirements:

(1) Welding procedure and welder performance tests must be made annually in accordance with section IX of the ASME Code. In addition to the essential variables named therein the following must be considered to be essential variables: Number of passes, thickness of plate, heat input per pass, and manufacturer's identification of rod and flux. The number of passes, thickness of plate and heat input per pass may not vary more than 25 per cent from the Procedure qualification. Records of the qualification must be retained for at least 5 years by the tank manufacturer and made available to duly identified representatives of the Canadian Transport Commission or the owner of the tank.

(2) Impact tests shall be made on a lot basis. A lot shall be defined as 100 tons or less of the same heat, and having thickness variation no greater than plus or minus 25 per cent. The minimum impact required for full size specimens shall be 20 ft.-lbs. (or 10ft.-lbs. for half sized specimens) at 0°F Charpy V-notch in both the longitudinal and transverse direction. If the lot test does not pass this requirement, individual plates may be accepted if they individually meet this impact test requirement.

(3) (Cancelled).

(b) Except as noted below, all openings in the tank shall be grouped in one location, either at the top of the tank or at one end of the tank.

Exceptions: (1) The openings for liquid level gauging devices, or for safety devices, may be installed separately at the other location or in the side of the shell; (2) one plugged opening of 2-inch National pipe Thread or less provided for maintenance purposes may be located elsewhere; (3) and opening of 3 inch National Pipe Size or less may be provided at another location when necessary, to facilitate installation of condensing coils.

(c) On and after August 31, 1953, every uninsulated portable tank shall, unless it be covered with a jacket made of aluminum, stainless steel, or other bright nontarnishing metal, be painted all over a white, aluminum, or similar reflecting color.

2. Material. (a) All material used for the construction of the tank and appurtenances shall be suitable for use with the commodity to be transported therein.

(b) A material of thickness less than 3/16 inch shall not be used for the shells and heads.

3. Design pressure. (a) The design pressure of a tank authorized under this specification shall be not less than the vapour pressure of the commodity contained therein at 115°F., or as prescribed for a particular commodity by Part 73, except that in no case shall the design pressure of any container be less than 100 psig nor more than 500 psig. When corrosion factor is prescribed by these regulations, the wall thickness of the tank calculated in accordance with the "Code" (see sec. 1(a)) shall be increased by 20 per cent or 0.10 inch, whichever is less.

NOTE 1: The term "design pressure" as used in this specification is identical to the term "maximum allowable working pressure" as used in "the Code" (see sec. 1 (a)).

4. Tank mountings. (a) Tanks shall be designed and fabricated with mountings to provide a secure base in transit. "Skids" or similar devices shall be deemed to comply with this requirement.

(b) All tank mountings such as skids, fastenings, brackets, cradles, lifting lugs, etc., intended to carry loadings shall be permanently secured to tanks in accordance with the requirements of the Code under which the tanks were fabricated and shall be designed to withstand static loadings in any direction equal to twice the weight of the tank and attachments when filled with the lading using a safety factor of not less than four, based on the ultimate strength of the material to be used. The specific gravity used in determining the static loadings shall be shown on the marking required by para. 6(a) and on the report required by para. 7(a).

(c) Lifting lugs or hold-down lugs may be added to either the tank or tank mountings. If lifting lugs and hold-down lugs are added directly to the tank, they shall be secured to doubling plates welded to the tank and located at points of support, except that lifting lugs or hold-down lugs with integral bases serving as doubling plates may be welded directly to the tank. Each lifting lug and hold-down lug shall be designed to withstand static loadings in any direction equal to twice the weight of the tank and attachments when filled with the lading using a safety factor of not less than four, based on the ultimate strength of the material to be used.

(d) All tank mountings shall be designed so as to prevent the concentration of excessive loads on the tank shell.

5. Protection of valves and accessories. (a) All valves, fittings, accessories, safety devices, gauging devices, and the like shall be adequately protected against mechanical damage.

(b) The protective device or housing shall comply with the requirements under which the tanks are fabricated with respect to design and construction, and shall be designed to withstand static loadings in any direction equal to twice the weight of the tank and attachments when filled with the lading using a safety factor of not less than four, based on the ultimate strength of the material to be used.

(c) Requirements concerning types of valves, retesting, and qualification of portable tanks contained in para. 73.32 and 73.315 must be observed.

6. Name plate. (a) In addition to the markings required by the Code (see para. 1(a)) under which tanks were constructed, they shall have permanently affixed, on one of the heads of the tank, a metal plate. This plate shall be permanently affixed by means of soldering, brazing, or welding around its complete perimeter. Neither the plate itself nor the means of attachment to the tank shall be subject to destructive attack by the contents of tank. Upon such plate shall be plainly marked by stamping, embossing, or other means of forming letters into or onto the metal of the plate itself the following information in characters at least 3/8 inch high:

Manufacturer's name ..... Serial No. .....
Owner's serial number .....
CTC Specification number .....
Water capacity (pounds) .....
Tare weight (pounds) .....
Design pressure (psig) .....
Design specific gravity .....
Original test date .....
Tank retested at ..... (psig) on .....

(b) All tank outlets and inlets, except safety relief valves, shall be marked to designate whether they communicate with vapour or liquid when the tank is filled to the maximum permitted filling density.

7. Report. (a) A copy of the manufacturer's data report required by the Code (see para. 1(a)) under which the tank is fabricated shall be furnished for each new tank to the owner, the Commission and the Bureau of Explosives. In addition, the manufacturer or owner shall register each tank with the Bureau of Explosives through the Commission in the following form:

Place .....
Date .....

Portable tank
Manufactured for ..... Company
Location .....
Manufactured by ..... Company
Location .....
Consigned to ..... Company
Location .....
Size ..... feet outside diameter by ..... long
Marks on tank as prescribed by para. 6 of this specification are as follows
Manufacturer's name .....Serial number .....
Owner's serial number .....
CTC Specification.....Code symbol .....
Date of manufacture .....
Water capacity (pounds).....
Tare weight (pounds) .....
Design pressure (psig).....
Design specific gravity .....

It is herby certified that this tank is in complete compliance with the requirements of CTC Specification No. 51.

(Signed) .....
(Manufacturer or owner)

Specification 52 (Cancelled)

Specification 53 (Cancelled)

Specification 56 and 57
PORTABLE TANKS

General design and construction requirements applicable to specifications 56 and 57 portable tanks.

1. General Requirements. (a) These specifications apply to tanks of any shape (cylinderical, conical, cubical, or other).

(b) The rated gross weight of the tank must not exceed the values used during the design qualification vibration and drop tests.

(c) Each tank must be in compliance with all applicable requirements of §§ 73.24 and 73.32.

2. Materials of construction. (a) Except for gaskets, pressure relief devices, valve seats, liners, and linings, all construction material must be metal.

(b) Hardware for handling and securing, fitting protection, outlet piping, valves, relief devices, and closures must be made of material that is electrolytically compatible with, or suitably protected from electrolytic action when joined to the product retention components of the tank.

(c) Any material used must not be susceptible to stress corrosion cracking.

(d) Material specification: All sheet, plate, and extruded material for shell, heads, bulkheads, and baffles for portable tanks must meet the following minimum requirements:

(1) Aluminum alloys. Aluminum alloys must be suitable for fusion welding and must meet the following requirements:

Minimum yield strength ..... 24,000 p.s.i.
Minimum ultimate strength ..... 30,000 p.s.i.
Minimum elongation of standard 2 inch gauge length ..... 8 percent

(2) Steel, Steel must meet the following requirements:

	Mild steel	Low alloy low carbon	Stainless
Minimum yield strength, p.s.i.	25,000	45,000	25,000
Minimum ultimate strength, p.s.i.	45,000	60,000	70,000
Minimum elongation of standard 2 inch gauge length (percent)	20	25	30

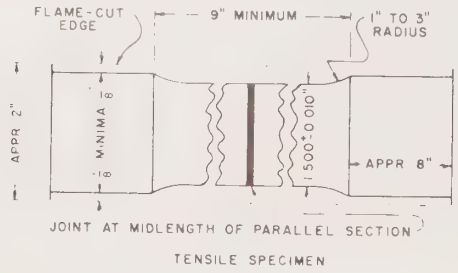
(3) Magnesium alloys. Magnesium alloy must conform to ASTM B-90-69. Grade ZE-10A.

3. General construction requirements. (a) Method of joining. All joints between tank shells, heads, baffles (or baffle attaching rings), and bulkheads must be welded in accordance with the requirements of this section.

(b) Strength of joints (Aluminum Alloy) (AL), Magnesium Alloy (MG)). All welded joints must be made in accordance with recognized good practice. The efficiency of a joint must not be less than 85 percent of the mechanical properties of the adjacent material. Each alloy must be joined by an inert gas arc welding process using filler metals which are consistent with material suppliers recommendation.

(c) Strength of joints (Mild Steel(MS), High Strength Low Alloy (HSLA), Austenitic Stainless Steel (SS)). Joints must be welded in accordance with recognized good practice. The efficiency of any joint must not be less than 85 percent of the mechanical properties of the adjacent material.

(d) Compliance test. Compliance with the requirements contained in paragraph (b) or (c) of this section for the welded joints must be determined by preparing two test specimens from materials representative of those to be used in each tank. Joints must be made by the same technique of fabrication and must conform to the figure below. Each specimen must be tested to failure under tension. One pair of test specimens may represent all the tanks to be made of the same combination of materials by the same technique of fabrication, and in the same shop, within 6 months after the tests on such samples have been completed. The butt welded specimens tested may be considered as qualifying other types or combinations of types of weld using the same filler material and welding process as long as parent metals are of the same types of material.



TENSILE SPECIMEN

4. Stacking, mounting, and tie-down provisions. (a) Load support devices. Each tank designed to be stacked in storage must be provided with load support devices. There may be no significant permanent deformation of the load support devices or the tank under either of the following stress conditions:

(1) Tanks loaded to their maximum authorized gross weight and stacked at least 18 feet high.

(2) A load on the support devices at least three times the maximum authorized gross weight of the tank.

(b) Base mounting. Each tank must be constructed with mountings to provide a secure base during transportation. The mounting may be in the form of a skid or similar structure.

(c) Tie-down system. If there are tie-down devices that are a structural part of the tank, the tie-down system must be capable of withstanding the following static loading without significant deformation to the tank. The static loading applied must have, with respect to the centre of gravity of the tank a vertical component of at least two times the maximum authorized gross weight of the tank.

(1) If the design of the tank necessitates specific front and side orientation when loaded on a transportation vehicle, the static loading applied must have two horizontal components at right angles to each other, one direction at a time as follows:

(i) A longitudinal component at least seven times the maximum authorized gross weight of the tank in the direction of travel of the vehicle, and

(ii) A component of five times the maximum authorized gross weight of the tank in the transverse direction, or

(2) If the design of the tank does not necessitate specific front and side orientation when loaded on a transportation vehicle, the static loading applied must have two horizontal components at right angles to each other, one direction at a time, of at least seven times the maximum authorized gross weight of the tank.

(d) If there is a structural part of the tank that could be used to tie the tank down and which is not in compliance with paragraph (c) of this section, it must be securely covered or locked during transportation to prevent its use as a tie-down.

5. Testing. (a) Design qualification testing. Design qualification tests prescribed in this paragraph must be made on at least one of each design and size tank, except that a set of tests, when made on a tank of one size, may serve to qualify smaller tanks made of same kind and thickness of material, by the same fabrication technique, and with identical supports, and equivalent closures, and other appurtenances. Tests must be performed sequentially on a single tank in the order listed in this section. Additional tests must be made if there is any increase in design size of the tank, any reduction in thickness of material, or any change in material, or in fabrication technique. Test samples must be retained for 1 year.

(1) Vibration and drop tests. See applicable spec. 56 or 57.

(2) Structural integrity tests—(i) Lifting devices. If there is a system of lifting devices that is a structural part of the tank or is permanently attached thereto or the support structure, the system must be capable of supporting at least three times the maximum gross weight of the tank, and each individual lifting device must be capable of supporting at least the maximum gross weight of the tank, without significant permanent deformation in either the lifting device system or in any part of the tank.

(ii) Shipment support structure. If the tank supports are a structural part of the tank, the supports must be capable of absorbing a force equal to the maximum gross weight of the tank or breaking without significant permanent deformation to the product retention component of the tank. The force must be applied to the supports at ground level from at least two horizontal directions at right angles to each other, one direction at a time.

(iii) Stacking support devices. If stacking support devices are a structural part of the tank, there must be no significant permanent deformation of any device or the tank under either of the following stress conditions:

(a) Tanks loaded to their maximum authorized gross weight and stacked at least 18 feet high.

(b) A load on the stacking support devices of at least three times the maximum authorized gross weight of the tank.

(iv) Fittings and protective devices. Each fitting (or its protective device) subject to this test requirement must be capable of withstanding a force at least two times the maximum authorized gross weight of the tank without resultant damage to the fitting. The force must be applied to the fitting or its protective device in at least two horizontal directions at right angles, to each other, one direction at a time, and in alignment with the fitting.

(b) Protection quality control, testing and inspection. See applicable specification, Section 3(b) of Spec. 56 or Section 5(b) of Spec. 57.

6. Rejected tanks. (a) No tank which fails to pass any of the prescribed tests may be placed in service until suitable repairs have been made and satisfactory re-tests results have been obtained.

7. Identification and marking. (a) A metal certification plate must be permanently affixed to each tank and must be readily accessible for inspection. The plate must be marked in letters and numerals at least 3/8-inch high by stamping, embossing, or other means of forming letters into or on the metal plate itself. The marking must contain at least the following information.

Tank manufacturer .....
Specification identification: Spec. 56 or Spec. 57 .....
Design pressure (for specification 57 only) ..... p.s.i.g.
Test pressure (for specification 56 only) ..... p.s.i.g.
Serial Number .....
Original test date .....
Tare weight ..... lbs.
Rated gross weight ..... lbs.
Volumetric capacity ..... U.S. gal. (or cu. ft.)
Materials of construction[2] .....

[1] The rated (permitted) gross weight may not exceed that weight used during the design qualification tests involving vibration and drop.

[2] E.g., AL for aluminum, MG for magnesium alloy, MS for mild steel, HSLA for high strength low alloy. SS for austenitic stainless steel, including ASTM or ASME reference.

(b) Unless the tank has been designed for stacking and meets the appropriate stacking integrity requirements of this specification, it must also be marked in letters at least 2 inches high in contrasting colours "Do Not Stack" and "Do Not Place Other Freight On Top Of This Tank", on at least two sides of the tank. These instructions must also appear on the certification plate. Plate markings are required to meet the requirements of paragraph (a) of this section and need not be in contrasting colour.

Specification 56, metal portable tank.

1. General requirements. (a) Each tank must be in compliance with the general design and construction requirements applicable to specs. 56 and 57 portable tanks in addition to the specific requirements of this section.

(b) Each tank may not exceed a rated gross weight of 7,000 pounds.

2. Openings. (a) Each fill and discharge opening must be equipped with a closure and locking device.

(b) A drum-type locking ring closure is authorized for openings not exceeding 23 inches in diameter. A drum-type locking ring closure must be at least a 12-gauge bolted ring with forged lugs having at least a 5/8-inch steel bolt tapped into one of the lugs. The locking ring must be equipped with a lock nut or equivalent device.

(c) For a tank that incorporates a hopper-type product discharge opening, the closure device must be constructed to retain product under the test conditions outlined in Section 5 of requirements applicable to specs. 56 and 57 and Section 3(a) of spec. 56. Closures for those openings must be designed with positive mechanical locking and sealing devices to prevent leakage during normal conditions incident to transportation.

3. Testing. (a) Design qualification testing. In addition to the testing prescribed in Section 5 (a) applicable to specs. 56 and 57, a vibration and a drop test are also required on each design. For these tests, the tank must be filled with a fine, dry powdered material having a density that results in the tank having a gross weight not less than the rated gross weight of the tank.

(1) Vibration test. This test must be performed for 1 hour using a minimum double amplitude of 1 inch at a frequency that causes the test tank to be raised from the floor of the testing table so a piece of flat steel strap may be passed between the tank and the table. The tank must be restrained so that all horizontal motion is restricted and only vertical motion is permitted.

(2) Drop test. The tank must be capable of withstanding without leakage of contents a 2-foot free drop onto a flat unyielding horizontal surface, striking the target surface in the position and attitude from which maximum damage to the tank (including closures) is expected.

(b) Production quality control, testing, and inspection—

(1) Leakage test. Each tank must be tested by a minimum air or hydrostatic pressure of at least 2 pounds per square inch gauge applied to the entire tank. If the air pressure is used, the entire surface of all joints under pressure must be coated with, or immersed in, a solution of soap and water, or other material suitable for the purpose of detecting leaks. If the hydrostatic pressure test is used it must be carried out by using water or other liquid having a similar viscosity, the temperature of which may not exceed 100°F. and all joints under pressure must be inspected for leaks. For either test, the pressure must be held for a period of time sufficiently long to assure detection of leaks. All closures must be in place during the test. Any tank that has detectable leakage or significant permanent deformation does not meet the requirements of this specification.

Specification 57, metal portable tank.

1. General requirements. (a) Each tank must be in compliance with the general design and construction requirements applicable to Specs. 56 and 57 portable tanks in addition to the specific requirements of this section.

(b) Each tank must have a capacity of at least 92 gallons but not more than 550 gallons.

2. Openings. (a) Each fill and discharge opening must be equipped with a closure device that meets the following requirements.:

(1) Any closure for a fill opening in excess of 20 square inches must be equipped with a device to prevent the closure from fully opening without first relieving internal pressure.

(2) Any product discharge valve, if used, must be provided with a leak tight device, such as a cap or plug.

(3) Each closure must be vapour tight.

(b) A drum-type locking ring closure is authorized for any opening less than 23 inches in diameter. A drum-type locking ring closure must be at least a 12-gauge bolted ring with forged lugs having at least a 5/8-inch steel bolt tapped into one of the lugs. The locking ring must be equipped with a lock nut or equivalent device.

3. Protection of fittings. (a) Each fitting which could be damaged sufficiently to result in leakage of tank contents must be protected by suitable guards or protective housings. The term "fitting" includes valves, closure devices, safety relief devices, and other accessories through which contents could leak from the tank. Each fitting or fitting protection device must be capable of withstanding the fitting protection test specified in the general requirements for specs. 56 and 57 (paragraph 5. Testing).

4. Vents. (a) Each tank must be equipped with at least one pressure relief device such as a spring-loaded valve, frangible disc or fusible plug.

(b) Each pressure relief device must communicate with the vapour space of the tank when the tank is in a normal transportation attitude. Shutoff valves must not be installed between the tank opening and any pressure relief device. Pressure relief devices must be mounted, shielded, or drained to prevent the accumulation of any material that could impair the operation or discharge capability of the device.

(c) The total emergency venting capacity (cu. ft./hr.) of each portable tank must be at least that determined from the following table.

Total surface area square feet[1,2]	Cubic feet free air per hour
20	15,800
30	23,700
40	31,600
50	39,500
60	47,400
70	55,300
80	63,300
90	71,200
100	79,100
120	94,900
140	110,700
160	126,500

[1]Interpolate for intermediate sizes.

[2]Surface area excludes area of legs.

(1) The pressure operated relief device must open at not less than 3 pounds per square inch gauge and at not over the design test pressure of the tank. The minimum venting capacity for pressure activated vents must be 6,000 cubic feet of free air per hour (measured at 14.7 p.s.i.a. and 60°F.) at not more than 5 pounds per square inch gauge.

(2) If a frangible device is used for relieving pressure, the device must have a minimum area of 1.25 square inches and must be rated at less than the design test pressure of the tank.

(3) If a fusible device is used for relieving pressure, the device must have a minimum area of 1.25 square inches. The device must function at a temperature between 220°F. and 300°F. and at a pressure less than the design test pressure of the tank, unless this latter function is accomplished by a separate device.

(d) No relief device may be used which would release flammable vapours under normal conditions of transportation (temperature up to and including 130°F.).

5. Testing. (a) Design qualification testing. In addition to the testing prescribed in the general requirements for specs. 56 and 57, (paragraph 5. Testing). A vibration test, a drop test, and a pressure test are also required on each design. For the vibration and drop tests, the tank must be filled with a liquid to not less than the rated gross weight.

(1) Vibration test. This test must be performed for 1 hour using a minimum double amplitude of 1 inch at a frequency that causes the test tank to be raised from the floor of the testing table so a piece of flat steel strap may be passed between the tank and the table. The tank must be restrained so that all horizontal motion is restricted and only vertical motion is permitted.

(2) Drop test. The tank must be capable of withstanding without leakage of contents a 2-foot free drop onto a flat unyielding horizontal surface, striking the target surface in the position and attitude from which maximum damage to the tank (including piping and fittings) is expected.

(3) Pressure test. The tank must be capable of maintaining, under hydrostatic test for at least 5 minutes, at least one and one-half times the design pressure prescribed in this paragraph, without detectable leakage or significant permanent deformation. The pressure must be measured at the top of the tank. Each closure must be in place and blocked if necessary as for shipment. Each closure must be standard, except that tapping for pressurizing and gaging is permitted. Design pressure must be determined as follows:

$$P = \frac{hd}{115} + 3$$

Where:

P = Design pressure in psig;
h = Inside height of tank in inches;
d = Maximum allowable density in pounds per gallon;
115 = Number of cubic inches in 1 gallon (231) divided by a safety factor of two

(b) Production quality control, testing and inspection—

(1) Leakage test. Each tank must be leak tested by a minimum sustained air pressure of at least three pounds per square inch gauge applied to the entire tank. The entire surface of all joint under pressure must be coated with or immersed in a solution of soap and water or other material suitable for the purpose of detecting leaks. The pressure must be held for a period of time sufficiently long to assure detection of leaks. All closures must be in place during the test, but safety relief devices may be removed and such openings plugged. Any tank that has detectable leakage or significant permanent deformation does not meet the requirements of this specification.

Specification 60

STEEL PORTABLE TANKS

1. General requirements. (a) Tanks must be of fusion welded construction, cylindrical in shape with seamless heads concave to the pressure. Tank shells may be of seamless construction.

(b) Tanks must be designed and constructed in accordance with and fulfill all the requirements of the ASME Code.

(c) Tanks, including all permanent attachments, must be stress relieved as a unit.

(d) Requirements concerning types of valves, retesting, and qualification of portable tanks contained in §§ 73.32 and 73.315 must be observed.

2. Material. (a) Material used in the tank must be steel of good weldable quality and conform with the requirements of the ASME Code.

(b) The minimum thickness of metal, exclusive of lining material, for shell and heads of tanks shall be as follows:

Tank capacity:	Minimum thickness (inch)
Not more than 1,000 gallons	1/4
Over 1,000 to 1,500 gallons	5/16
Over 1,500 gallons	3/8

3. Expansion domes. (a) Expansion domes, if applied, must have a minimum capacity of one per cent of the combined capacity of the tank and dome.

4. Closures for manholes and domes (a) The manhole cover shall be designed to provide a secure closure of the manhole. All covers, not hinged to the tanks, shall be attached to the outside of the dome by at least 1/8 inch chain or its equivalent. Closures shall be made tight against leakage of vapour and liquid by use of gaskets of suitable material.

5. Bottom discharge outlets. (a) Bottom discharge outlets prohibited, except on tanks used for shipments of sludge acid and alkaline corrosive liquids.

(b) If installed, bottom outlets or bottom washout chambers shall be of metal not subject to rapid deterioration by the lading, and each shall be provided with a valve or plug at its upper end and liquid-tight closure at its lower end. Every such valve or plug shall be designed to insure against unseating due to stresses or shocks incident to transportation. Bottom outlets shall be adequately protected against handling damage and outlet equipment must not extend to within less than one inch of the bottom bearing surface of the skids or tank mounting.

6. Loading and unloading accessories. (a) When installed, gauging, loading and air inlet devices, including their valves, shall be provided with adequate means for their secure closure; and means shall also be provided for the closing of pipe connections of valves.

(b) Interior heater coils, if installed, must be of extra heavy pipe and so constructed that breaking off of exterior connections will not cause leakage of tanks.

7. Protection of valves and accessories. (a) All valves, fittings, accessories, safety devices, gauging devices, and the like shall be adequately protected against mechanical damage by a housing closed with a cover plate.

(b) Protective housing shall comply with the requirements under which the tanks are fabricated with respect to design and construction, and shall be designed with a minimum factor of safety of four to withstand loadings in any direction equal to two times the weight of the tank and attachments when filled with water.

8. Safety devices. (a) Safety devices are to be as required, subject to approval of the Commission or Bureau of Explosives, by shipping regulations.

9. Compartments. (a) When the interior of the tank is divided into compartments, each compartment shall be designed, constructed and tested as a separate tank. Thickness of shell and compartment heads shall be determined on the basis of total tank capacity.

10. Lining. (a) If a lining is required, the material used for lining the tank shall be homogeneous, non-porous, imperforate when applied, not less elastic than the metal of the tank proper. It shall be of substantially uniform thickness, not less than 1/22 inch thick if metallic, and not less than 1/16 inch thick if non-metallic, and shall be directly bonded or attached by other equally satisfactory means. Rubber lining shall be not less than 3/16 inch thick. Joints and seams in the lining shall be made by fusing the material together or by other equally satisfactory means. The interior of the tank shall be free from scale, oxidation, moisture and all foreign matter during the lining operation.

11. Tank mountings. (a) Tanks shall be designed and fabricated with mountings to provide a secure base in transit. "Skids" or similar devices shall be deemed to comply with this requirement.

(b) All tank mountings such as skids, fastenings, brackets, cradles, lifting lugs, etc., intended to carry loadings shall be permanently secured to tanks in accordance with the requirements under which the tanks are fabricated, and shall be designed with a factor of safety of four, and built to withstand loadings in any direction equal to two times the weight of the tanks and attachments when filled to the maximum permissible loaded weight.

(c) Lifting lugs or side hold-down lugs shall be provided on the tank mountings in a manner suitable for attaching lifting gear and hold-down devices. Lifting lugs and hold-down lugs welded directly to the tank shall be of the pad-eye type. Doubling plates welded to the tank and located at the points of support shall be deemed to comply with this requirement.

(d) All tank mountings shall be so designed as to prevent the concentration of excessive loads on the tank shell.

12. Pressure test. (a) Each completed portable tank prior to application of lining shall be tested before being put into transportation service by completely filling the tank with water or other liquid having a similar viscosity, the temperature of which shall not exceed 100°F. during the test, and applying a pressure of 60 pounds per square inch gauge. The tank shall be capable of holding the prescribed pressure for at least 10 minutes without leakage, evidence of impending failure, or failure. All closures shall be in place while the test is made and the pressure shall be gauged at the top of the tank. Safety devices and/or vents shall be plugged during this test.

13. Repair of tanks. (a) Tanks failing to meet the test may be repaired and retested, provided that repairs are made in complete compliance with the requirements of this specification.

14. Marking. (a) In addition to marking required by the American Society of Mechanical Engineers Code, every tank shall bear permanent marks at least 3/8 inch high stamped into the metal near the centre of one of the tank heads or stamped into a plate permanently attached to the tank by means of brazing or welding or other suitable means as follows:

Manufacturer's name .....Serial No. .....
CTC specification .....
Nominal capacity .....(gallons)
Tare weight .....(pounds)
Date of manufacture .....

15. Report. (a) A copy of the manufacturer's data report required by the "Code" (see para. 1 (a)) under which the tank is fabricated shall be furnished for each new tank to the owner, the Commission and the Bureau of Explosives. In addition, the manufacturer or owner shall register each tank with the Bureau of Explosives through the Canadian Transport Commission in the following form:

(Place) .....
(Date) .....
Portable tank
Manufactured for .....Company
Location .....
Manufactured by .....Company
Location .....
Consigned to .....Company
Location .....
Size .....feet outside diameter by .....long
Marks on tank as prescribed by para. 14 of this specification are as follows:
Manufacturer's name .....
Serial number .....
Owner's serial number .....
CTC specification .....
ASME Code Symbol (par U-201) .....
Date of manufacture .....
Nominal capacity .....(gallons)

It is hereby certified that this tank is in complete compliance with the requirements of CTC Specification No. 60.

(Signed) .....
Manufacturer or owner

Appendix A—Specifications for Steel

TABLE I

Open-hearth, basic oxygen, or electric steel of uniform quality. The following chemical composition limits are based on ladle analysis:

Designation	Chemical composition per cent-ladle analysis		
	Grade 1[1]	Grade 2[1,2]	Grade 3[3,4,5]
Carbon	0.10/0.20	0.24 maximum	0.22 maximum
Manganese	1.10/1.60	0.50/1.00	1.25 maximum
Phosphorus, maximum	0.04	0.04	0.045[6]
Sulphur, maximum	0.05	0.05	0.05
Silicon	0.15/0.30	0.30 maximum	—
Copper, maximum	0.40	—	—
Columbium	—	0.01/0.04	—
Heat treatment authorized	[3]	[3]	[3]
Maximum stress (psi.)	35,000	35,000	35,000

[1] Addition of other elements to obtain alloying effect is not authorized.
[2] Ferritic grain size 6 or finer according to ASTM E112-63
[3] Any suitable heat treatment in excess of 1,100°F., except that liquid quenching is not permitted.
[4] Other alloying elements may be added and shall be reported.
[5] For compositions with a maximum carbon content of 0.15 per cent on ladle analysis, the maximum limit for manganese on ladle analysis may be 1.40 per cent.
[6] Rephosphorized Grade 3 steels containing no more than 0.15 per cent phosphorus are permitted if carbon content does not exceed 0.15 per cent and manganese does not exceed 1 per cent.

CHECK ANALYSIS TOLERANCES

A heat of steel made under any of the above grades, the ladle analysis of which is slightly out of the specified range, is acceptable if the check analysis is within the following variations:

Element	Limit or maximum specified (per cent)	Tolerance (per cent) over the maximum limit or under the minimum limit	
		Under minimum limit	Over maximum limit
Carbon	To 0.15 inclusive	0.02	0.03
	Over 0.15 to 0.40 inclusive	0.03	0.04
Manganese	To 0.60 inclusive	0.03	0.03
	Over 0.60 to 1.15 inclusive	0.04	0.04
	Over 1.15 to 2.50 inclusive	0.05	0.05
Phosphorus[7]	All ranges	—	0.01
Sulphur	All ranges	—	0.01
Silicon	To 0.30 inclusive	0.02	0.03
	Over 0.30 to 1.00 inclusive	0.05	0.05
Copper	To 1.00 inclusive	0.03	0.03
	Over 1.00 to 2.00 inclusive	0.05	0.05
Nickel	To 1.00 inclusive	0.03	0.03
	Over 1.00 to 2.00 inclusive	0.05	0.05
Chromium	To 0.90 inclusive	0.03	0.03
	Over 0.90 to 2.10 inclusive	0.05	0.05
Molybdenum	To 0.20 inclusive	0.01	0.01
	Over 0.20 to 0.40 inclusive	0.02	0.02
Zirconium	All ranges	0.01	0.05
Columbian	To 0.04 inclusive	0.005	0.01
Aluminum	Over 0.10 to 0.20 inclusive	0.04	0.04
	Over 0.20 to 0.30 inclusive	0.05	0.05

[7] Rephosphorized steels not subject to check analysis for phosphorus.

Appendix B—Specifications for Plastics

TABLE I

Polyethylene must have the following properties, as determined by the American Society For Testing Materials (ASTM) methods designated. Tests must be performed on resin with additives included:

Property	Type I	Type II	Type III	ASTM method
Density, g/cc	0.910-V0.926	0.926-V0.941	0.941-V0.965	D 1508-68
Melt index (flow rate)	2.0 max.	1.0 max.	1.0 max.	D 1238-65T
Tensile strength	1,500 psi. min.	1,800 psi.	3,000 psi.	D 638-68
Elongation	400% min.	400%	75%	D 638-68

Other materials may be added to polyethylene resin provided they do not adversely affect the physical properties specified above.

Part 79—SPECIFICATIONS FOR TANK CARS

This Part 79 added effective August 31, 1965.

Subpart A—Introduction, Approvals and Reports

Sec.
79.1 General.
79.2 Definitions and abbreviations.
79.3 Procedure for securing approval.
79.4 Changes in specifications for tank cars.
79.5 Certificate of construction.
79.6 Repairs and alterations.

Subpart B—General Design Requirements

79.10 Tank mounting.
79.11 Welding certification.
79.12 Interior heater systems.
79.13 Tank car capacity and gross weight limitation.
79.14 Tank car couplers.

Subpart C—Specifications for Pressure Tank Car Tanks (Classes CTC 105, 109,112, and 114)

79.100 General specifications applicable to pressure tank car tanks.
79.101 Individual specification requirements applicable to pressure tank car tanks.
79.102 Special commodity requirements for pressure tank car tanks.
79.106 Special requirements for specification 105 tank cars.

Subpart D—Specifications for Non-Pressure Tank Car Tanks (Classes CTC 103, 104, 111AF, 111AW, and 115AW)

79.200 General specifications applicable to non-pressure tank car tanks. (Classes CTC 103, 104, 111)
79.201 Individual specification requirements applicable to non-pressure tank car tanks.
79.202 Special commodity requirements for non-pressure tank car tanks
79.220 General specifications applicable to non-pressure tank car tanks consisting of an inner container supported within an outer shell (Class CTC-115).
79.221 Individual specification requirements applicable to tank car tanks consisting of an inner container supported within an outer shell.

Subpart E—Specifications for Multi-Unit Tank Car Tanks (Classes CTC-106A and 110AW)

79.300 General specifications applicable to multi-unit tank car tanks designed to be removed from car structure for filling and emptying (classes 106A and 110A-W).
79.301 Individual specification requirements for multi-unit tank car tanks.
79.302 Special commodity requirements for multi-unit tank car tanks.

Subpart F—Specifications for Liquefied Hydrogen Tank Car Tanks and Seamless Steel Tanks (Classes CTC-113A-W and 107-A)

79.400 General specifications applicable to liquefied hydrogen tank car tanks.
79.401 Individual specification requirements for liquefied hydrogen tank car tanks.
79.500 Specification CTC-107A****, seamless steel tank car tanks.

SUBPART A—INTRODUCTION, APPROVALS AND REPORTS

§ 79.1 General. (a) Except where retrofit requirements are prescribed herein, tanks that form part of a tank car and are used for the transportation of dangerous goods must comply with all applicable requirements of this part.

(b) Tanks built to specifications predating those in this part may continue in use subject to 73.31.

(c) Any person who performs a function prescribed in this part shall perform that function in accordance with this part.

(d) Where this part requires a tank to be marked with a CTC specification (for example CTC 105A100W), compliance with that requirement is the responsibility of the tank builder. Marking the tank with the CTC specification shall be understood to be certification by the builder that the functions performed by the builder have been performed in compliance with this part.

§ 79.2 Definitions and abbreviations. (a) The following apply in Part 79:

(1) "AAR" means Association of American Railroads.

(2) "Approved" means approval by the AAR Committee on Tank Cars.

(3) "ASTM" means American Society for Testing and Materials.

(4) "Commission" means Canadian Transport Commission.

(5) Definitions in Part 73 also apply.

(6) "C" means degrees Celsius.

(7) "F." means degrees Fahrenheit.

(8) "NGT" means National Gas Taper Threads.

(9) "NPT" means American Standard Taper Pipe Thread.

(10) "kPa" means kilopascals.

(11) "psi" means pounds per square inch gauge.

(12) "tanks" means tank car tanks.

(13) "MPa" means megapascals.

§ 79.3 Procedure for securing approval. (a) Application for approval of designs, material and construction, conversion or alteration of tank car tanks under these specifications, complete with detailed prints, shall be submitted in prescribed

form to the Secretary, Mechanical Division, AAR, for consideration by its Committee on Tank Cars and other appropriate committees. Approvals or rejections of applications, based on appropriate committee action, shall be issued by said Secretary.

(b) When, in the opinion of the Committee, such tanks or equipment therefor are not in compliance with effective regulations and specifications of the Commissions, the application will be approved.

(c) When, in the opinion of the Committee, such tanks or equipment therefore are not in compliance with effective regulations and specifications of the Commission, the Committee may recommend service trials to determine the merits of a change in specifications. such service trials may be authorized by the Commission under the terms "CTC Special Permits."

§ 79.4 Changes in specifications for tank cars. (a) Proposed changes in or additions to specifications for tanks shall be submitted to the Secretary, Mechanical Division, AAR, for consideration by its Committee on Tank Cars. An application for construction of tanks to any new specification may be submitted with proposed specification. Construction should not be started until the specification has been approved or special permit has been issued. When proposing a new specification, the applicant shall furnish information to justify a new specification. This data should include the properties of the lading and the method of loading and unloading.

(b) The Subcommittee on Specifications of the Committee on Tank Cars shall review the proposed specification at its earliest convenience and report its recommendations to the Committee on Tank Cars for prompt consideration. The Committee on Tank Cars shall report its recommendations through said Secretary to the Commission; such reports may be submitted to the Bureau of Explosives for its recommendation before action by the Commission. Expert opinion thus obtained will be given due consideration by the Commission in determining appropriate action.

§ 79.5 Certificate of construction. (a) Before a single unit tank car tank that is built in Canada is placed in service, the builder or owner shall provide to the Commission a Certificate of Construction for the tank (Form AAR 4-2) executed in a manner satisfactory to the Commission.

(b) Before a tank of Class CTC-106A, CTC-107A, or 110A is placed in service, the builder must furnish a Certificate of Construction, Form AAR4-2 to the owner, the Bureau of Explosives (as required by paragraph (d) of this section), and the Secretary, Mechanical Division, AAR, in addition to a Certificate of Inspector's Report as required in § 79.300-20 and § 79.500-18 in prescribed form certifying that the tank and appurtenances comply with all the requirements of the specifications.

(c) When tank car tanks built in series are identical in all details, one Certificate of Construction shall suffice for the series.

§ 79.6 Repairs and alterations. (a)For procedures to be followed in making repairs or alterations, see Appendices B and R of the AAR Specifications for Tank Cars.

SUBPART B—GENERAL DESIGN REQUIREMENTS

§79.10 Tank mounting. (a) The manner in which tanks are attached to the car structure shall be approved. The use of rivets to secure anchors to tanks prohibited.

§79.11 Welding certification. (a) Welding procedures, welders and fabricators shall be approved.

§79.12 Interior heater systems.

§79.12.1 General. (a) Interior heater systems shall be of approved design and materials. If a tank is divided into compartments, a separate system shall be provided for each compartment.

§79.12.2 Materials and dimensions. (a) Interior heater systems and plug flanges, if welded to tank or dome, shall be cast, forged or fabricated metal, and be of good weldable quality in conjunction with metal of tank or dome.

(b) Piping must be not less than 2 inches IPS. Tubing must be not less than 2⅜ inches outside diameter and the wall thickness must be at least equivalent to the corresponding pipe size. Material specifications and nominal wall thickness must be as follows:

(c) Systems may be fabricated of other materials and of other than circular cross section, if approved.

Material	Nominal thickness minimum[1]		Specifications ASTM
	2 inches	Over 2 inches	
Carbon steel	0.175	Schedule 40	A53-69a, A192-69, A178-70.
Alloy steel	Schedule 40S	Schedule 40S	A312-70, A269-69.
Aluminum	Schedule 80	Schedule 80	B241-69, B210-70, B221-69.
Nickel	Schedule 40	Schedule 40	B161-70.

[1]Thickness must be increased 25 per cent or to next higher schedule, whichever is less, when threaded joints are used.

§79.12-3 Joints and fittings. (a) Welded butt joints are preferable. Bolted joints with flange welded to piping may be used if welding is not feasible or to facilitate tank cleaning or application of linings. Return bends shall be forged or made by bending the pipe. Cast, forged or fabricated manifolds of approved design may be used.

(b) Inlets and outlets of heater systems shall be equipped with valve cock, cap or plug. Caps and plugs shall be secured by chain.

§79.12-4 Application to tank. (a) Interior heater systems shall be so constructed that the breaking off of their external connections will not cause leakage of contents of tank.

(b) Inlets and outlets may be located in any portion of dome, shell, heads, or steam jacketed outlet provided proper drainage of heater system is accomplished.

(c) If ends of coils are not attached to a manifold or steam jacketed outlet, they shall be attached to pads or reinforcements. Such reinforcements must be attached to tank in compliance with the requirements of the tank specification.

(1) Outside pipe connections to steam coils shall not be an integral part of the interior coils and shall be screwed or welded, or both, into outside of pads or reinforcements.

(d) All piping shall be secured so as to permit necessary expansion and contraction.

§79.12-5 Tests. (a) Each interior heater system shall be hydrostatically tested at not less than 200 psi. and shall hold the pressure for 10 minutes without leakage or evidence of

distress.

§79.12-6 **Reports.** (a) The Certificate of Construction for the completed car shall indicate installation of interior heater system and date of initial hydrostatic test.

§79.12-7 **Stencilling.** (a) To indicate that tank is equipped with interior heater system, the tank, or the jacket if tank is insulated, shall be stencilled in compliance with the applicable requirements of AAR Specifications for Tank Cars, Appendix C.

§79.13 **Tank car capacity and gross weight limitation** (a) New tank cars shall not exceed, and existing tank cars may not be converted to exceed, 130,600 litres (28,750 gallons) shell full capacity or 119,300 kilograms (263,000 pounds) gross weight on rail.

§79.14 **Tank Car Couplers.** (a) After February 28, 1985 all tank cars used for carrying dangerous goods shall be equipped with double shelf couplers as follows:

(1) E top and bottom shelf couplers designated as Association of American Railroads' Catalog No. SE60CHT, SE60CHTE, SE67BHT, SE67BHTE, SE68BHT or SE68BHTE; or

(2) F top shelf couplers designated as Association of American Railroads' Catalog No. SF70CHT, SF70CHTE, SF73AHT, SF73AHTE, SF79CHT or SF79CHTE.

SUBPART C—SPECIFICATIONS FOR PRESSURE TANK CAR TANKS

§79.100 General specifications applicable to pressure tank car tanks.

§ 79.100-1 Tanks built under these specifications (§ 79.101-1) shall comply with the requirements of this Subpart, (§§ 79.100, 79.101, and § 79.102).

§ 79.100-2 **Approval.** (a) For procedure for securing approval see § 79.3.

§ 79.100-3 **Type.** (a) Tanks built under this specification shall be fusion-welded with heads designed convex outward. They shall be circular in cross section, shall be provided with a manhole nozzle on top of the tank of sufficient size to permit access to the interior, a manhole cover to provide for the mounting of all valves, measuring and sampling devices, and a protective housing. Other openings in the tank are prohibited, except as provided in Part 73, §§ 79.100-14, 79.101-1a Table Note 10, 79.102.

§ 79.100-4 **Insulation.** (a) If insulation is applied, the tank shell and manway nozzle must be insulated with an approved material. The entire insulation must be covered with a metal jacket of a thickness not less than 11 gauge (0.1196 inch) nominal (Manufacturers' Standard Gauge) and flashed around all openings so as to be weathertight. The exterior surface of a carbon steel tank, and the inside surface of a carbon steel jacket must be given a protective coating except that a protective coating is not required when foam-in-place insulation that adheres to the tank or jacket is applied.

(b) If insulation is a specification requirement, it shall be of sufficient thickness so that the thermal conductance at 60°F. is not more than 0.075 Btu. per hour, per square foot, per degree F. temperature diffential. If exterior heaters are attached to tank, the thickness of the insulation over each heater element may be reduced to one-half that required for the shell.

§ 79.100-5 **Bursting pressure.** (a) The minimum required bursting pressure is listed in § 79.101.

§ 79.100-6 **Thickness of plates.** (a) The wall thickness after forming of the tank shell and heads must not be less than that specified in § 79.101, nor that calculated by the following formula:

$$t = \frac{Pd}{2SE}$$

where:

d = Inside diameter in inches;
E = 1.0 welded joint efficiency; except for heads with seams = 0.9;
P = Minimum required bursting pressure in p.s.i.;
S = Minimum tensile strength of plate material in p.s.i., as prescribed in § 79.100-7;
t = Minimum thickness of plate in inches after forming.

(b) If plates are clad with material having tensile strength properties at least equal to the base plate, the cladding may be considered a part of the base plate when determining thickness. If cladding material does not have tensile strength at least equal to the base plate, the base plate alone shall meet the thickness requirement.

(c) When aluminum plate is used, the minimum width of bottom sheet of tank shall be 60 inches, measured on the arc, but in all cases the width shall be sufficient to bring the entire width of the longitudinal welded joint, including welds, above the bolster.

§ 79.100-7 **Material.** (a) Steel plate: Steel plate materials used to fabricate tank shell and manhole nozzle must comply with one of the following specifications with the indicated minimum tensile strength and elongation in the welded condition. The maximum allowable carbon content must be 0.31 percent when the individual specification allows carbon greater than this amount. The plates may be clad with other approved materials.

Specifications	Minimum tensile strength (psi) welded condition[1]	Minimum elongation in 2 inches (per cent) welded condition (longitudinal)
ASTM A 516-Gr. 70	70,000	20
AAR TC128-Gr.B	81,000	19
ASTM A 537-Cl.1	70,000	23
ASTM A 302-Gr.B	80,000	20

[1]Maximum stresses to be used in calculations

(b) Aluminum alloy plate: Aluminum alloy plate material used to fabricate tank shell and manhole nozzle must be suitable for fusion welding and must comply with one of the following specifications with its indicated minimum tensile strength and elongation in the welded condition.

Specifications	Minimum tensile strength 0 temper (psi) welded conditions[3]	Minimum elongation in 2 inches 0 temper (per cent) welded condition (longitudinal)
ASTM B 209 Alloy 5052[1]	25,000	18
ASTM B 209 Alloy 5083[2]	38,000	16
ASTM B 209 Alloy 5086[1]	35,000	14
ASTM B 209 Alloy 5154[1]	30,000	18
ASTM B 209 Alloy 5254[1]	30,000	18
ASTM B 209 Alloy 5454[1]	31,000	18
ASTM B 209 Alloy 5652[1]	25,000	18

[1]For fabrication the parent plate material may be 0, H112, or H32 temper, but design calculations must be based on minimum tensile strength shown.

[2]0 Temper only.

[3]Weld filler metal 5556 must not be used.

[4]Not authorized for tank shells, manholes or domes.

[5]Maximum stress to be used in calculations.

(c) All attachments welded to tank shell must be of approved material which is suitable for welding to the tank.

§ 79.100-8 Tank heads. (a) The tank head shape shall be an ellipsoid of revolution in which the major axis shall equal the diameter of the shell adjacent to the head and the minor axis shall be one-half the major axis.

(b) Each tank head made from steel which is required to be fine "grain" by the material specification, and which is hot formed at a temperature exceeding 1700 degrees F., must be normalized after forming by heating to a temperature between 1550 degrees and 1700 degrees F., by holding at that temperature for at least 1 hour per inch of thickness (30 minute minimum), and then by cooling in air. If the material specification requires quenching and tempering, the treatment specified in that specification must be used instead of the one specified above.

§ 79.100-9 Welding. (a) All joints shall be fusion-welded in compliance with the requirements of AAR Specifications for Tank Cars, Appendix W. Welding procedures, welders and fabricators shall be approved.

§ 79.100-10 Postweld heat treatment. (a) After welding is complete, steel tanks and all attachments welded thereto must be postweld heat treated as a unit in compliance with the requirements of AAR Specifications for Tank Cars, Appendix W.

(b) For aluminum tanks, postweld heat treatment is prohibited.

§ 79.100-11 Tank mounting. (a) See § 79.10.

§ 79.100-12 Manhole nozzle, cover and protective housing. (a) Manhole nozzles must be of approved design of forged or rolled steel for steel tanks or of fabricated aluminum alloy for aluminum tanks, with access opening at least 18 inches inside diameter or at least 14 inches by 18 inches around or oval. Nozzle must be welded to the tank and the opening reinforced in an approved manner in compliance with the requirements of AAR Specifications for Tank Cars, Appendix E, Figure E10.

(b) Manhole cover shall be machined to approved dimensions and be of forged or rolled carbon or alloy steel, rolled aluminum alloy or nickel when required by the lading. Minimum thickness is listed in § 79.101. Manhole cover shall be attached to manhole nozzle by through or stud bolts not entering tank.

(c) Protective housing of cast, forged or fabricated approved materials must be bolted to manhole cover with not less than twenty 3/4-inch studs. The shearing value of the bolts attaching protective housing to manhole cover must not exceed 70 percent of the shearing value of bolts attaching manhole cover to manhole nozzle. Housing must have steel sidewalls not less than three-fourths inch in thickness and must be equipped with a metal cover not less than one-fourth inch in thickness that can be securely closed. Housing cover must have suitable stop to prevent cover striking loading and unloading connections and be hinged on one side only with approved riveted pin or rod with nuts and cotters. Openings in wall of housing must be equipped with screw plugs or other closures.

§ 79.100-13 Venting, loading and unloading valves, measuring and sampling services. (a) Venting , loading and unloading valves shall be of approved design, made of metal not subject to rapid deterioration by the lading, and shall withstand the tank test pressure without leakage. The valves shall be directly bolted to seatings on manhole cover. Valve outlets shall be closed with approved screw plugs or other closures fastened to prevent misplacement.

(b) The interior pipes of the loading and unloading valves shall be anchored and, except as prescribed in § 79.102, may be equipped with excess flow valves of approved design.

(c) Gauging device, sampling valve and thermometer well are not specification requirements. When used, they shall be of approved design, made of metal not subject to rapid deterioration by the lading, and shall withstand the tank test pressure without leakage. Interior pipes of the gauging device and sampling valve, except as prescribed in § 79.102, may be equipped with excess flow valves of approved design. Interior pipe of the thermometer well shall be anchored in an approved manner to prevent breakage due to vibration. The thermometer well shall be closed by an approved valve attached close to the manhole cover, or other approved location, and closed by a screw plug. Other approved arrangements that permit testing thermometer well for leaks without complete removal of the closure may be used.

(d) An excess flow valve as referred to in this specification, is a device which closes automatically against the outward flow of the content of the tank such as may be encountered in case the external closure valve is broken off or removed during transit. Excess flow valves may be designed with a by-pass to allow the equalization of pressures.

(e) Bottom of tank shell may be equipped with sump or siphon bowl, or both, welded or pressed into the shell. Such sumps or siphon bowls if applied, are not limited in size and must be made of cast, forged or fabricated metal. Each sump or syphon bowl must be of good welding quality in conjunction with the metal of the tank shell. When the sump or siphon bowl is pressed in the bottom of the tank shell, the wall thickness of the pressed section must not be less than that specified for the shell. The section of a circular cross section tank to which a sump or siphon bowl is attached need not comply with the out-of-roundness requirement specified in AAR Specifications for Tank Cars, Appendix W. W14.06. Any portion of a sump or siphon bowl not forming a part of cylinder of revolution must have walls of such thickness and be so reinforced that the stresses in the walls caused by a given internal pressure are no greater

than the circumferential stress which would exist under the same internal pressure in the wall of a tank of circular cross section designed in accordance with § 79.100-6(a). In no case less than that specified in § 79.101-1(a).

§ 79.100-14 Bottom outlets. (a) Bottom outlets for discharge of lading are prohibited. If indicated in § 79.101, tank may be equipped with a bottom washout of approved construction. If applied, bottom washouts must not extend more than 6" from the shell of the tank and for stub sill tank car tanks bottom washouts shall be in accordance with AAR specification for tank cars paragraph E 9.00.

(1) Bottom washout shall be of cast, forged or fabricated metal and shall be fusion-welded to the tank. It shall be of good weldable quality in conjunction with metal of tank.

(2) The closure plug and seat shall be readily accessible or removable for repairs.

(3) The closure of the washout nozzle must be equipped with a 3/4-inch solid screw plug.

(4) Joints between closures and their seats may be gasketed with suitable material.

§ 79.100-15 Safety relief valves. (a) The tank must be equipped with one or more safety relief valves of approved design, made of metal not subject to rapid deterioration by the lading. The safety relief valve, or valves, must be mounted on manhole cover. The total valve discharge capacity must be sufficient to prevent building up pressure in tank in excess of 82½ percent of the tank test pressure or 10 p.s.i. above the start-to-discharge pressure, whichever is higher. The start-to-discharge and vapour-tight pressures must comply with § 79.101 and must not be affected by any auxiliary closure or other combination. For certain commodities, alternate pressures are permitted (see § 79.102-11). See AAR Specifications for Tank Cars, Appendix A for formula for calculating discharge capacity. The relieving or discharge capacity for all 105J, 109J and 112 tank cars used in flammable gas and anhydrous ammonia service shall be calculated in accordance with the formula prescribed in A8.02 of Appendix A of AAR Specifications for Tank Cars applicable for compressed gases in non-insulated tanks.

(b) When a safety relief valve is used in combination with a breaking pin device, the breaking pin device must be designed to fail at a pressure of 75 percent of the tank test pressure and safety relief valve must be set for a start-to-discharge pressure of 71 percent of the tank test pressure. However, for spec. CTC-105 500W tanks, the start-to-discharge pressure must be 360 p.s.i. For certain commodities, alternate pressures are permitted (see § 79.102-11).

(c) When a safety relief valve is used in combination with a frangible disc, the frangible disc must be designed to burst at a pressure of 75 percent of the tank test pressure and the safety relief valve must be set for start-to-discharge pressure of 71 percent of the tank test pressure, as prescribed in § 79.101. Provisions must be made to prevent any accumulation of pressure between the frangible disc and safety relief valve. For certain commodities, alternate pressures are permitted (see § 79.102-11).

(d) Notwithstanding paragraph (a) of this section the relieving or discharge capacity of the safety relief valve on specification 105J tank cars built to transport ethylene oxide may be as low as 1100 scfm at 85 psi if the tank is equipped with a thermal protection system that can be demonstrated to the Commission's satisfaction to be capable of keeping the tank below 550 degrees F in a 100 minute pool fire test.

(e) Notwithstanding paragraph (a) of this section, 105J & 109J cars built before March 1, 1984 need not use the formula referred to therein if the tank is equipped with a thermal protection system that can be demonstrated to the Commission's satisfaction to be capable of keeping the tank below 550 degrees F in:

(1) A pool fire for 100 minutes and

(2) A torch fire for 30 minutes.

§ 79.100-16 Attachments. (a) Reinforcing pads must be used between external brackets and shells if the attachment welds exceed 6 linear inches of 1/4-inch fillet or equivalent weld per bracket or bracket leg. When reinforcing pads are used, they must not be less than one-fourth inch in thickness, have each corner rounded to a 1 inch minimum radius, and be attached to the tank by continuous fillet welds except for venting provisions. The ultimate shear strength of the bracket-to-reinforcing pad weld must not exceed 85 percent of the ultimate shear strength of the reinforcing pad-to-tank weld.

(b) Attachments not otherwise specified shall be applied by approved means.

§ 79.100-17 Closures for openings. (a) Closures shall be of approved design and made of metal not subject to rapid deterioration by the lading. Plugs, if used, shall be solid, with NPT threads, and shall be of a length which will screw at least six threads inside the face of fitting or tank.

§ 79.100-18 Tests of tanks. (a) Each tank shall be tested by completely filling tank and manhole nozzle with water or other liquid having similar viscosity, at a temperature which shall not exceed 100°F. during the test; and applying the pressure prescribed in § 79.101. The tank shall hold the prescribed pressure for at least 10 minutes without leakage or evidence of distress.

(b) Insulated tanks shall be tested before insulation is applied.

(c) Caulking of welded joints to stop leaks developed during the foregoing test is prohibited. Repairs in welded joints shall be made as prescribed in AAR specifications for Tank Cars. Appendix W.

(d) Testing of exterior heaters is not a specification requirement/

§ 79.100-19 Tests of safety relief valves. (a) Each valve shall be tested by air or gas for compliance with § 79.101 before being put into service.

§ 79.100-20 Stamping. (a) To certify that the tank complies with all specification requirements, each tank shall be plainly and permanently stamped in letters and figures at least 3/8 inch high into the metal near the center of both outside heads as follows:

	Example of required stamping
SPECIFICATION	CTC-105A100-W
MATERIAL	ASTM A515-70
CLADDING MATERIAL (If any)	ASTM A240-304 Clad
TANK BUILDER'S INITIALS ...	ABC
DATE OR ORIGINAL TEST	00-0000

	Example of required stamping
CAR ASSEMBLER (If other than tank builder)	DEF
WATER CAPACITY	00000 LBS.

§ 79.100-21 Stencilling. (a) The tank or the jacket if tank is insulated, shall be stencilled in compliance with the requirements of AAR Specifications for Tank Cars, Appendix C.

(b) Water capacity stencil is required.

(c) Each specification 112 tank car that is equipped with a tank puncture resistance system as specified in § 79.100-23 shall have the letter "S" substituted for the "A" in the specification marking.

(d) Each specification 112 tank car that is equipped with a head puncture resistance system that meets the requirements of § 79.100-23 and a thermal protection system enclosed in a metal jacket that meets the requirements of § 79,100-24 shall be stencilled by having the letter "J" substituted for the letter "A" in the specification marking.

(e) Each specification 112 tank car that is equipped with a head puncture resistance system that meets the requirements of § 79.100-23 and a non-jacketed thermal protection system that meets the requirements of § 79.100-24 shall be stencilled by having the letter "T" substituted for the letter "A" in the specification marking.

(f) Each specification 105 tank car that is equipped with a head puncture resistance system that meets the requirements of § 79.100-23 shall be stencilled by having the letter "S" substituted for the letter "A" in the specification marking.

(g) Each specification 105 tank car that is equipped with a head puncture resistance system that meets the requirements of § 79,100-23, a thermal protection system that meets the requirements of § 79.100-24 and a safety relief valve that meets the requirements of § 79.100-15 shall be stencilled by having the letter "J" substituted for the letter "A" in the specification marking.

(h) Both sides and both ends of each pressure tank car that transports Class 2 gases after July 1st, 1990 must have a one foot wide orange band approximately centered on a horizontal plane that passes through the centerline of the tank heads. The band must completely encircle the tank car except that lettering other than the orange colour may appear in the band. Safety appliances and handbrake parts need not be of the orange colour.

§ 79.100-22 Certificate of construction. (a) See § 79.5.

§ 79.100-23 Tank head puncture resistance system. (a) All 112S, 112T, 112J, 105S, 105J, 109S and 109J pressure tank cars are required to be equipped with a head shield.

(1) Head shields shall be at least ½ inch thick and made from steel produced in accordance with specifications ASTM A242, A572-GR.50, A515-GR.70, A516-Gr,70 or TC-128.B.

(2) The shield shall be of a size large enough to cover the projected area of the full head of the tank.

(3) The design of the head shield must be approved.

(b) Notwithstanding paragraph (a) of this section, specification 105J tank cars built with a test pressure of 500 psi or more need not be equipped with a tank head puncture resistance system.

(c) Notwithstanding paragraph (a) of this section in the case of specification 112 and 114 tank cars built or retrofitted before May 15, 1984 a tank head puncture resistance system that was approved by the Commission prior to that date is acceptable.

§ 79.100-24 Thermal protection. (a) All 112T, 112J, 105J and 109J pressure tank cars are required to be equipped with a thermal protection system acceptable to the Commission that maintains the surface temperature below 800°F when subjected to:

(1) A pool fire for 100 minutes and

(2) A torch fire for 30 minutes.

(b) The Commission maintains a list of thermal protection systems which comply with the requirements of this section.

(c) An analysis is required to verify that the entire surface of the tank car tank, including the tank at discontinuous structures (eg. stub sills, protective housings etc.) complies with paragraph (a) of this section.

(d) Notwithstanding the provisions of § 79.101-1(a) Table Note 4, specification 112 pressure tank cars equipped with thermal protection under this section need not be painted white.

§ 79.101 Individual specification requirements applicable to pressure tank car tanks.

§ 79.101-1 Individual specification requirements. (a) In addition to § 79.100 the individual specification requirements are as shown:

CTC SPECIFICATIONS	105A100[11] ALW	105A100W[11]	105A200[11] ALW	105A200W[11]	105A300[1] ALW	105A300W[1]	105A400W[1]	105A500W[1]	105A600W[1]	109A100[1] ALW
Material (see 79.100-7)	Alu. alloy	Steel	Alu. alloy	Steel	Alu. alloy	Steel	Steel	Steel	Steel	Alu. alloy
Insulation (see 79.100-4)	Required	Required	Required	Required	Required	Required	Required	Required	Required	Optional
Bursting pressure, p.s.i. (see 79.100-5)	500	500	500	500	750	750	1,000	1,250	1,500	500
Minimum plate thickness, inches, shell and heads	5/8	9/16[35]	5/8	9/16[35]	5/8	11/16[1]	11/16[1]	11/16[1]	11/16[1]	5/8
Test pressure, p.s.i. (see 79.100-18)	100	100	200	200	300	300	400	500	600	100
Safety relief valves, p.s.i.[6] Start-to-discharge	75	75	150	150	225	225	300	375	450	75
Pressure, p.s.i. Start-to-discharge	±3.0	±3.0	±4.5	±4.5	±6.75	±6.75	±9.0	±11.25	±13.5	±3.0
Tolerance, p.s.i. Vapour tight (minimum)	60	60	120	120	180	180	240	300	360	60
Pressure, p.s.i. Valve flow rating pressure (maximum p.s.i.)	85	85	165	165	247.5	247.5	330	412.5	495	85
Manhole cover, thickness, inches (minimum)	2 1/2[2]	2 1/2	2 1/2[2]	2 1/4	2 5/8[2]	2 1/4[9]	2 1/4[9]	2 1/4	2 1/4	2 1/2[2]
Special references	79-102-3	79-102-3 79-102-6 79-102-12 79-102-17 79-102-20	79-102-3	79-102-3 79-102-6 79-102-17	79-102-3	79-102-2 79-102-3 79-102-5 79-102-6 79-102-7 79-102-8 79-102-11 79-102-13 79-102-15 79-102-16 79-102-17	79-102-3 79-102-17	79-102-1 79-102-2 79-102-3 79-102-9 79-102-10 79-102-14 79-102-18	79-102-1 79-102-3 79-102-4 79-102-9 79-102-10 79-102-17	
Bottom washout	Prohibited	Prohibited	Prohibited	Prohibited	Prohibited	Prohibited	Prohibited	Prohibited	Prohibited	Optional
Bottom outlet	Prohibited	Prohibited	Prohibited	Prohibited	Prohibited	Prohibited	Prohibited	Prohibited	Prohibited	Prohibited

CTC SPECIFICATIONS	109A200[11] ALW	109A300[11] ALW	109A300W[13]	112A200W[12]	112A340W[12]	112A400W[12]	112A500W[12]
Material (see 79.100-7)	Alu. alloy	Alu. alloy	Steel	Steel	Steel	Steel	Steel
Insulation (see 79.100-4)	Optional	Optional	Optional	None[4]	None[4]	None[4]	None[1]
Bursting pressure, p.s.i. (see 79.100-5)	500	750	750	500	850	1,000	1,250
Minimum plate thickness, inches, shell and heads	5/8	5/8	11/16[1]	9/16[35]	11/16[1]	11/16[1]	11/16[1]
Test pressure, p.s.i. (see 79.100-18)	200	300	300	200	340	400	500
Safety relief valves, p.s.i.[6] Start-to-discharge	150	225	225	150	255	300	375
Pressure, p.s.i. Start-to-discharge	±4.5	±6.75	±6.75	±4.5	±7.65	±9.0	±11.25
Tolerance, p.s.i. Vapour tight (minimum)	120	180	180	120	204	240	300
Pressure, p.s.i. Valve flow rating pressure (maximum p.s.i.)	165	247.5	247.5	165	280.5	330	412.5
Manhole cover, thickness, inches (minimum)	2 1/2[2]	2 5/8[2]	2 1/4	2 1/4	2 1/4	2 1/4	2 1/4
Special references				79-102-3[10] 79-102-17	79-102-3[10] 79-102-11 79-102-17	79-102-3[10] 79-102-6 79-102-11 79-102-13 79-102-17	79-102-3[10] 79-102-17
Bottom washout	Optional	Optional	Optional	Prohibited	Prohibited	Prohibited	Prohibited
Bottom outlet	Prohibited	Prohibited	Prohibited	Prohibited	Prohibited	Prohibited	Prohibited

[1]When steel of 65,000 to 81,000 p.s.i. minimum tensile strength is used, the thickness of plates shall be not less the 5/8 inch, and when steel of 81,000 p.s.i. minimum tensile strength is used, the minimum thickness of plate shall be not less than 9/16 inch.

[2]When approved material other than aluminum alloys are used, the thickness shall be not less than 2 1/4 inches.

[3]When steel of 65,000 p.s.i. minimum tensile strength is used, minimum thickness of plates shall be not less than 1/2 inch.

[4]At least the upper two-thirds of the exterior of the tank and the manway, nozzle and all appurtenances in contact with this area of the tank shall have a finish coat of white paint; except that tanks used for hydrogen fluoride may have a dark coloured band not exceeding 14 feet wide around the centre of the tank in the top platform and fitting area.

[5]For inside diameter of 87 inches or less, the thickness of plates shall be not less than 1/2 inch.

[6]Sec. 79.102-11 for optional setting for certain commodities.

[7]See AAR specifications for tank cars, appendix E, E4.01 and 179.103-2.

[8]Purposely left blank.

[9]When the use of nickel is required by the lading, the thickness shall not be less than 2 inches.

[10]Each tank head may be equipped with not more than one opening for use in purging tank interior.

[11]When a tank head puncture resistance system meeting the requirements of § 79.100-23, a thermal protection system meeting the requirements of § 79.100 24 and a safety relief valve that meets the requirements of § 79.100-15 have been applied, a J must be substituted for the A in the specification marking.

[12]When a tank head puncture resistance system meeting the requirements of § 79.100-23 and a thermal protection system meeting the requirements of § 79.100-24 have been applied, a J or T must be substituted for the A in the specifications marking.

§ 79.102 Special commodity requirements for pressure tank car tanks. (a) In addition to §§ 79.100 and 79.101 the following requirements are applicable:

§ 79.102-1 Liquefied carbon dioxide. (a) Tank cars used to transport liquefied carbon dioxide must comply with the following special requirements:

(1) Tank plates, manway nozzles and anchorages of tanks must be made of carbon steel complying with ASTM Specification A516-79b, Grades 55, 60, 65, or 70, or AAR Specification TC128-78, Grade B. The ASTM A516 plate must also meet the Charpy V-Notch test requirements of ASTM A20-79b (see Table 16) in the longitudinal direction of rolling. The TC128 plate must also meet the Charpy V-Notch energy absorption requirements of 15 ft-lb minimum average for 3 specimens and 10 ft-lb minimum for one specimen at minus 50°F in the longitudinal direction of rolling in accord with ASTM Specification A370-77. Production-welded test plates prepared as required by W4.00 or AAR Specifications for Tank Cars, Appendix W, must include impact test specimens or weld metal and heat-affected zone. As an alternative, anchor legs may be fabricated of stainless steel, ASTM Specification A240-79 Types 304, 304L, 316 or 316L, for which impact tests are not required.

(2) Tank shall be insulated with an approved material of sufficient thickness so that the thermal conductance at 60°F. is not more than 0.03 Btu. per hour per square foot per degree F. temperature differential; except that in order to permit an anchorage which shall not exceed seven inches from top of centre sills to bottom of tank, the insulation thickness directly over the sills may be reduced to give thermal conductance not exceeding 0.04 Btu. per hour per square foot per degree F. temperature differential.

(3) Tank shall be equipped with one safety relief valve set for the start-to-discharge pressure listed in § 79.101, and one safety vent of approved design, set to function at a pressure less than the tank test pressure, and not less than 75 per cent of tank test pressure. The discharge capacity of each of these safety relief devices shall be sufficient to prevent building up pressure in tank in excess of 82½ per cent of the tank pressure.

(4) Tank shall be equipped with two pressure-regulating valves of approved design, set to open at a pressure not exceeding 350 psi on spec. 105A500-W tanks or 400 psi spec. 105A600-W tanks.

(5) Each regulating valve and safety relief device shall have its final discharge piped to the outside of the protective housing.

(6) Tank anchor-to-tank shell fillets welds must be examined by a suitable nondestructive testing method to ensure that welds are free from cracks or other detrimental defects.

§ 79.102-2 Chlorine. (a) Each tank car used to transport chlorine must comply with all of the following:

(1) Each tank must be constructed in compliance with spec. 105A500-W. A tank car must be operated and the jacket stencilled either 105A300-W or 105A500-W, and each tank must be equipped with the safety relief valve required by the stencilled specification.

(2) Interior pipes of liquid discharge valves must be equipped with excess flow valves of approved design.

(3) Insulation must be 4 inches minimum of corkboard or of self-extinguishing polyurethane foam or must be 2 inches minimum thickness of 4 pounds per cubic foot minimum density ceramic fibre covered by 2 inches minimum thickness glass fibre.

(4) Tanks must be fabricated from carbon steel complying with ASTM Specification A516-70a, Grade 70, or AAR Specification TC-128-70, Grade A or B.

§ 79.102-3 Liquefied flammable gases. (a) Any authorized tank car used to transport liquefied flammable gases must comply with the following special requirements:

(1) The interior pipes of the loading and unloading valves and sampling valves, also the gauging device when it provides a means for passage of the lading from the interior to the exterior of the tank, must be equipped with excess flow valves of an approved design. If the opening for passage of lading through the gauging device is not more than 0.060-inch diameter, an excess flow valve is not required.

(2) The protective housing cover must be provided with an opening above each safety relief valve which must be concentric with the discharge of the valve and have an area at least equal to the valve outlet area. Each opening must be provided with a weatherproof cover designed for vertical discharge.

(3) Gaskets for manhole cover plates and for mounting of fittings must be asbestos type or approved high-temperature resistant equivalent.

§ 79.102-4 Vinyl fluoride, inhibited. Each tank used to transport vinyl fluoride, inhibited, must comply with the following special requirements:

(a) The tank must comply with Specification 105A600W and must be designed for loading at minus 50 degrees F. or colder.

(b) All plates for the tank and appurtenances must be fabricated of:

(1) Stainless steel, ASTM specification A240, Type 304, 304L, 316 or 316L, in which case impact tests are not required; or

(2) Steel complying with ASTM Specification A516; Grade 70; ASTM Specification A537, Class 1; or AAR Specification TC128, Grade B, in which case impact tests must be performed as follows:

(i) ASTM Specification A516 and A537 material must meet the Charpy V-notch test requirements, in longitudinal direction of rolling, of ASTM Specification A20.

(ii) AAR Specification TC128 material must meet the Charpy V-notch test requirements, in longitudinal direction of rolling, of 15 ft.-lb. minimum average for 3 specimens, with 10 ft.-lb. minimum for any one specimen, at minus 50 degrees F. or colder, in accordance with ASTM Specification A370.

(iii) Production welded test plates must:

(A) Be prepared in accordance with AAR Specifications for Tank Cars, Appendix W,W4.00;

(B) Include impact specimens of weld metal and heat-affected zone, prepared and tested in accordance with AAR Specifications for Tank Cars, Appendix W, W9.00; and

(C) Meet the same impact requirements as the plate material.

(c) Insulation must be of approved material.

(d) The tank must be equipped with at least one safety relief

valve, set for the start-to-discharge pressure listed in 79.101-1. The discharge capacity of each safety relief device must be sufficient to prevent the build-up of pressure in the tank in excess of 83½ percent of the tank test pressure. The discharge from each safety relief device must be directed outside the protective housing.

(c) Excess flow valves must be installed under all liquid and vapour valves, except safety relief valves.

(f) A thermometer well may be installed.

(g) A gauging device may be installed. If one is installed it must be a fixed length dip tube.

(h) A pressure gauge may be installed.

(i) Aluminum, copper, silver, zinc, or an alloy containing any of these metals may not be used in the tank construction, or in fittings in contact with the lading.

(j) The jacket must be stencilled, adjacent to the water capacity stencil, "MINIMUM OPERATING TEMPERATURE °F."

(k) The tank car and insulation must be designed to prevent the vapour pressure of the lading from increasing from the pressure at the maximum allowable filling density to the start-to-discharge pressure of the safety relief valve within 30 days, at an ambient temperature of 90 degrees F.

(l) Tank anchor-to-tank shell fillet welds must be examined by a suitable non-destructive testing technique to ensure welds are free from cracks or other detrimental defects.

§ 79.102-5 Nitrosyl chloride. (a) Tank cars used to transport nitrosyl chloride must comply with the following special requirements:

(1) Tanks shall be made of or clad with a metal not subject to rapid deterioration by the lading; all appurtenances such as manhole covers, venting, loading and unloading valves, safety relief valves, excess flow valves, and eduction pipes, shall be made of metal not subject to rapid deterioration by the lading; cork shall be used as an insulating material.

§ 79.102-6 Vinyl chloride or Vinyl methyl ether, inhibited. (a) Tank cars used to transport vinyl chloride, or vinyl methyl ether, inhibited, must comply with the following special requirements:

(1) All parts of valves and safety relief devices in contact with the lading must be of a metal or other material suitably treated; if necessary, which will not cause formation of any acetylides.

(2) The interior pipes of the loading and unloading valves and sampling valve, also the gauging device when it provides a means for passage of the lading from the interior to the exterior of the tank, must be equipped with excess flow valves of an approved design. If the opening for passage of lading through the gauging device is not more than 0.060 inch diameter, an excess flow valve is not required.

(3) For vinyl chloride in spec. 105A200W tank cars, openings in tank heads to facilitate nickel lining are authorized if closed in an approved manner.

(4) For alternate safety relief valve settings, see § 79.102-11.

(5) For gasket requirements, see § 79.102-11(b).

§ 79.102-7 Bromine. (a) Tank cars used to transport bromine must comply with the following special requirements:

(1) The tank shall be nickel clad at least 20 per cent or shall be lined with lead at least 3/16 inch thick; openings in tank heads to facilitate application of lead lining are authorized if closed in an approved manner; all closures and appurtenances in contact with the lading shall be lead lined or shall be made of metal not subject to rapid deterioration by the lading; all interior welds in nickel clad tanks shall be protected by pure nickel butt straps to eliminate iron contamination. Except as otherwise provided herein, the water weight capacity of the tank shall not exceed 20,400 pounds. When tanks are equipped with manhole cover plates, safety relief valves, venting, loading and unloading valves in accordance with spec. 105A-300-W, and tank jackets are stencilled spec. 105A300-W, but in all other respects are constructed and maintained in full compliance with spec. 105A500-W, the water weight capacity of the tank shall not exceed 37,400 pounds.

§ 79.102-8 Motor fuel anti-knock compound. (a) Tank cars used to transport motor fuel anti-knock compounds must comply with the following special requirements.

(1) Openings in tank heads to facilitate application of nickel lining are authorized if closed in an approved manner.

§ 79.102-9 Nitrogen tetroxide or nitrogen tetroxide nitric oxide mixtures. (a) Tank cars used to transport nitrogen tetroxide or nitrogen tetroxide-nitric oxide mixtures must comply with the following special requirements.

(1) Tanks shall be insulated with not less than four inches of corkboard. All valves and fittings shall be protected by the securely attached cover made of metal not subject to rapid deterioration by the lading, and all valve openings, except the safety relief valves, shall be fitted with screw plugs or caps to prevent leakage in the event of valve failure. Safety relief valves shall be equipped with an approved stainless steel or platinum frangible disc. Written procedure covering details of tank car appurtenances, manhole fittings and safety relief devices, and marking, loading, handling, inspection and testing practices, shall be filed with and approved by the Bureau of Explosives through the Commission before any tank car is offered for transportation of these commodities.

§ 79.102-10 Hydrocyanic acid. (a) Tank cars used to transport hydrocyanic acid must comply with the following special requirements:

(1) Cars shall be registered and the jacket stencilled 105A300W and be equipped with the safety relief valves required by that specification. Tanks shall be insulated with not less than 4 inches of corkboard. Written procedure covering details of tank car appurtenances, manhole fittings and safety relief devices, and marking, loading, handling, inspection and testing practices, shall be filed with and approved by the Bureau of Explosives through the Commission before any tank car is offered for transportation of hydrocyanic acid.

§ 79.102-11 Liquefied petroleum gas, butadiene, anhydrous ammonia, methylacetylene-propadiene, stabilized, or vinyl chloride. (a) Tank cars used to transport liquified petroleum gas, butadiene, anhydrous ammonia, methylacetylene-propadiene, stabilized, or vinyl chloride may as an alternate comply with the following special requirements:

(1) Safety relief valves may be set to the following pressures, provided the total valve discharge capacity is sufficient to prevent building up pressure in the tank in excess of 90 per cent of the tank test pressure.

Safety relief valves, p.s.i.	CTC Specifications		
	105A300W	112A340W, 114A340W	112A400W, 114A400W
Start-to-discharge pressure	247.5	280.5	330
Start-to-discharge tolerance	±7.5	±8.4	±10
Vapour tight pressure (minimum)	196	224	264
Flow rating pressure	270	306	360

(b) Gaskets for manhole covers and for mounting of fittings must be asbestos type or approved high-temperature resistant equivalent.

(c) Notwithstanding the provisions of paragraph 79.100-24 (a) of this subpart, specification 112 and 114 tank cars built before June 14, 1982 but not more than 25 years old, and used to carry anhydrous ammonia, are not required to be equipped with a thermal protection system.

*§ **79.102-12 Ethylene oxide.** (a) Each tank car used to transport ethylene oxide shall comply with the following special requirements:

(1) The tank shall be constructed in accordance with 105A***W specification, and its jacket stenciled 105A100W.

(2) Each safety relief valve must conform to CTC-105J100W tank car specification. Each safety relief valve shall have its discharge piped to the top of the manway bonnet assembly. Vapor exit from the assembly shall be provided through a full opening weather cap located directly above the safety valve vent pipe.

(3) Copper, silver, mercury, magnesium, or their alloys shall not be used in any part of the tank or appurtenances if that part of appurtenance is normally in contact with ethylene oxide liquid or vapor.

(4) Interior pipes of liquid discharge valves, vapor lines, gaging devices (when the device provides a means for passage of the lading from the interior to the exterior of the tank) and sampling lines must be equipped with excess flow valves of an approved design.

(5) Each tank shall be equipped with a thermometer well.

(6) Each tank shall be insulated with glass fiber except tank cars built before January 31, 1975, are authorized in this service when insulated with cork.

(7) The manway protective housing and cover shall be insulated with glass fiber or other material that will provide protection against heat deterioration of the valves and any resilient material contained within the housing.

(8) Neoprene, natural rubber, and asbestos gaskets are prohibited. All O-rings, packings and gaskets, shall be constructed of materials which do not react spontaneously with or lower the autoignition temperature of ethylene oxide.

§ 79.102-13 Hydrogen fluoride, anhydrous (a) Tank cars used to transport hydrogen fluoride, anhydrous, must comply with the following special requirements:

(1) Tanks must be equipped with valves and appurtenances approved for this particular service, made of metal not subject to rapid deterioration by the lading. For safety relief valves, see § 79.100-15.

(2) Bottom opening in tank prohibited.

(3) Notwithstanding the provisions of paragraph 79.100-24(a) of this Part specification 112 or 114 tank cars used to carry hydrogen fluoride anhydrous are not required to be equipped with a thermal protection system.

§ 79.102-14 Acrolein inhibited. Each tank car used to transport acrolein inhibited must be a specification 105A300W, or higher rated tank registered and the jacket stencilled 105A200W and must be equipped with the safety relief valve required by that specification.

§ 79.102-15 Sodium, metallic. Tank cars used to transport metallic sodium must have exterior heater coils fusion welded to tank shell.

§ 79.102-16 Sulphur trioxide stabilized. (a) Tank cars used to transport sulphur trioxide stabilized must be equipped with safety relief valves of approved design. Tanks equipped with interior heating coils not permitted.

§ 79.102-17 Hydrogen chloride, refrigerated liquid. Tank cars used to transport hydrogen chloride, refrigerated liquid, must comply with the following special requirements:

(a) The tank must comply with Specification 105A600W and must be designed for loading at minus 50 degrees F. or colder.

(b) All plates for the tanks and appurtenances must be fabricated of:

(1) Stainless steel, ASTM Specification A240, Type 304, 304L, 316, or 316L, in which case impact tests are not required; or;

(2) Steel complying with ASTM Specification A516, Grade 70; ASTM Specification A537, Class 1; or AAR Specification TC-128, Grade B, in which case impact tests must be performed as follows:

(i) ASTM Specification A516 and A537 material must meet the Charpy-V-notch test requirements, in longitudinal direction of rolling, of ASTM Specification A20.

(ii) AAR Specification TC-128 material must meet the Charpy V-notch test requirements, in longitudinal direction of rolling, of 15 ft.-lb. minimum average for 3 specimens, with a 10ft.-lb. minimum for any one specimen, at minus 50 degrees F. or colder, in accordance with ASTM Specification A370.

(iii) Production welded test plates must—

(A) Be prepared in accordance with AAR Specifications for Tank Cars, Appendix W, W4.00;

(B) Include impact test specimens of weld metal and heat-affected zone, prepared and tested in accordance with AAR Specifications for Tank Cars, Appendix W, W9.00; and

(C) Meet the same impact requirements as the plate material.

(c) Insulation must be of approved material.

(d) Safety relief valves must be trimmed with monel, or other approved material and equipped with a frangible disc of silver, a fluorinated hydrocarbon polymer coated monel, or tantalum. Each safety relief device shall have the space between the frangible disc and the relief valve vented with a suitable auxiliary valve. The discharge from each safety relief device must be directed outside the protective housing.

(e) Loading and unloading valves must be trimmed with Hastelloy B or C, monel, or other approved material, and identified as "Vapour" or "Liquid". Excess flow valves

must be installed under all liquid and vapour valves, except safety relief valves.

(f) A thermometer well may be installed.

(g) Only an approved gauging device may be installed.

(h) A sump must be installed in the bottom of the tank under the liquid pipes.

(i) All gaskets must be made of, or coated with, a fluorinated hydrocarbon polymer, or other approved material.

(j) The tank car tank may be equipped with exterior cooling coils on top of the tank car shell.

(k) The jacket must be stencilled, adjacent to the water capacity stencil, "MINIMUM OPERATING TEMPERATURE F."

(l) The tank car and insulation must be designed to prevent the vapour pressure of the lading from increasing from the pressure at the maximum allowable filling density to the start-to-discharge pressure of the safety relief valve within 30 days at an ambient temperature of 90 degrees F.

(m) Tank anchor-to-tank shell fillet welds must be examined by a suitable non-destructive testing method to ensure that welds are free from cracks or other detrimental defects.

§ 79.102-20 Dimethyl hydrazine unsymmetrical. Class 105AW tank cars used to transport dimethyl hydrazine unsymmetrical must be stenciled 105A100W. Tanks must be equipped with steel or stainless steel safety relief valves of the type and size used on spec. 105A100W tank cars.

§ 79.106 Special requirements for Specification 105 tank cars. (a) In addition to the requirements of this section, every specification 105 tank car shall meet the applicable requirements of sections 79.100, 79.101 and 79.102.

(b) Notwithstanding the provisions of sections 79.3, 79.4 and 79.6, AAR approval is not required for changes in or additions to specification 105 tank cars which are necessary in order to comply with this section.

(c) Notwithstanding the provisions of § 73.8 except for tank cars dedicated to liquid carbon dioxide service, each specification 105 tank car built after January 1st 1986 with a test pressure in excess of 100 p.s.i. shall conform to class CTC-105J.

SUBPART D—SPECIFICATIONS FOR NON-PRESSURE TANK CAR TANKS

§ 79.200 General specifications applicable to non-pressure tank car tanks. (a) (Classes 103, 104, and 111).

§ 79.200-1 Tanks built under these specifications must meet the requirements of §§ 79.200, 79.201, and when applicable § 79.202.

§ 79.200-2 Approval. (a) For procedure for securing approval see § 79.3.

§ 79.200-3 Type. Tank built under these specifications must be circular in cross section, with formed heads designed convex outward. When specified in § 79.201-1, the tank must have at least one manhole or one expansion dome with manhole, and such other external projections as are prescribed herein. When the tank is divided into compartments, each compartment must be treated as a separate tank.

§ 79.200-4 Insulation. (a) If insulation is applied, the tank shell and expansion dome when used must be insulated with an approved material. The entire insulation must be covered with a metal jacket of a thickness not less than 11 gauge (0.1196 inch) nominal (Manufacturer's Standard Gauge) and flashed around all openings so as to be weather tight. The exterior surface of a carbon steel tank and the inside surface of a carbon steel jacket must be given a protective coating, except that protective coating is not required when foam-in-place insulation that adheres to the tank or jacket is applied.

(b) If insulation is a specification requirement, it shall be of sufficient thickness so that the thermal conductance at 60°F. is not more the 0.225 Btu. per hour, per square foot, per degree F. temperature differential, unless otherwise provided in § 79.201-1. If exterior heaters are attached to tank, the thickness of the insulation over each heater element may be reduced to one-half that required for the shell.

§ 79.200-5 Bursting pressure. (a) The minimum required bursting pressure is listed in § 79.201-1.

§ 79.200-6 Thickness of plates. (a) The wall thickness after forming of the tank shell, dome shell, and of 2:1 ellipsoidal heads must be not less than specified in § 79.201-1, nor that calculated by the following formula:

$$t = \frac{Pd}{2SE}$$

where:

d = Inside diameter in inches;
E = 0.9 Welded joint efficiency; except
E = 1.0 seamless heads;
P = Minimum required bursting pressure in psi.;
S = Minimum tensile strength of plate material in psi. as prescribed in § 79.200-7.
t = Minimum thickness of plate in inches after forming;

(b) The wall thickness after forming of 3:1 ellipsoidal heads must be not less than specified in § 79.201-2, nor that calculated by the following formula:

$$t = \frac{Pd}{2SE} \times 1.83$$

where:

d = Inside diameter in inches;
E = 0.9 Welded joint efficiency; except
E = 1.0 seamless heads;
P = Minimum required bursting pressure in psi.;
S = Minimum tensile strength of plate material in psi. as prescribed in § 79.200-7.
t = Minimum thickness of plate in inches after forming;

(c) The wall thickness after forming of a flanged and dished head must be not less than specified in § 79.201-1, nor that calculated by the following formula:

$$t = \frac{5PL}{6SE}$$

where:

E = 0.9 Welded joint efficiency; except
E = 1.0 seamless heads;
L = Main inside radius to which head is dished, measured on concave side in inches;
P = Minimum required bursting pressure in psi.;
S = Minimum tensile strength of plate material in psi. as prescribed in § 79.200-7.
t = Minimum thickness of plate in inches after forming;

(d) If plates are clad with material having tensile strength properties at least equal to the base plate, the cladding may be considered a part of the base plate when determining thickness. If cladding material does not have tensile strength at least equal to the base plate, the base plate alone must meet the thickness requirements.

(e) For a tank constructed of longitudinal sections, the minimum width of bottom sheet of the tank must be 60 inches measured on the arc, but in all cases the width must be sufficient to bring the entire width of the longitudinal welded joint, including welds, above the bolster.

(f) For a tank built of one piece cylindrical sections, the thickness specified for bottom sheet must apply to the entire cylindrical section.

(g) See § 79.200-9 for thickness requirements for a compartmented tank.

§ 79.200-7 Materials. (a) Plate material used to fabricate the tank and, when used, expansion dome or manhole nozzle material, must meet one of the following specifications with the indicated minimum tensile strength and elongation in the welded condition.

(b) Carbon steel plate: The maximum allowable carbon contents must be 0.31 per cent when the individual specification allows carbon content greater than this amount. The plates may be clad with other approved materials:

Specifications	Minimum tensile strength (psi) welded condition[1]	Minimum elongation in 2 inches (per cent) welded condition (longitudinal)
ASTM A 515, Gr. 55	55,000	28
ASTM A 515, Gr. 60	60,000	25
ASTM A 515, Gr. 65	65,000	20
ASTM A 515, Gr. 70	70,000	20
ASTM A 285, Gr. A	45,000	29
ASTM A 285, Gr. B	50,000	20
ASTM A 285, Gr. C	55,000	20
ASTM A 516, Gr. 55	55,000	28
ASTM A 516, Gr. 60	60,000	25
ASTM A 516, Gr. 65	65,000	20
ASTM A 516, Gr. 70	70,000	20
AAR TC128, Gr. B	81,000	19

[1]Maximum stresses to be used in calculations.

(c) Aluminum alloy plate: Aluminum alloy plate must be suitable for welding and comply with one of the following specifications:

Specifications	Minimum tensile strength (psi) 0 temper welded condition[3][6]	Minimum elongation in 2 inches (per cent) 0 temper welded condition (longitudinal)
ASTM B 209, Alloy 5052[1]	25,000	18
ASTM B 209, Alloy 5083[2]	38,000	16
ASTM B 206, Alloy 5086[1]	35,000	14
ASTM B 209, Alloy 5154[1]	30,000	18
ASTM B 209, Alloy 5254[1]	30,000	18
ASTM B 209, Alloy 5454[1]	31,000	18
ASTM B 209, Alloy 5652[1]	25,000	18
ASTM B 209, Alloy 6061[4]	24,000[5]	5[5]

[1]For fabrication the parent plate material may be 0, H112, or H32 temper, but design calculations must be based on minimum tensile strength shown.
[2]0 temper only.
[3]Weld filler metal 5556 must not be used.
[4]Not authorized for tank shell, manholes or domes.
[5]T6 temper only.
[6]Maximum stresses to be used in calculations.

(d) High alloy steel plate: High alloy steel plate must comply with one of the following specifications:

Specifications	Minimum tensile strength (psi) welded condition[1]	Minimum elongation in 2 inches (per cent) welded condition (longitudinal)
ASTM A 240, Type 304	75,000	30
ASTM A 240, Type 304L	70,000	30
ASTM A 240, Type 316	75,000	30
ASTM A 240, Type 316L	70,000	30

[1]Maximum stresses to be used in calculations.
[2]High alloy steel materials used to fabricate tank and expansion dome, when used, must be tested in accordance with the following procedures in ASTM Specification A 262-68 titled, "Recommended Practices for Detecting Susceptibility to Intergranular Attack in Stainless Steels," and must exhibit corrosion rates not exceeding the following:

Test procedure	Material	Corrosion rate i.p.m.
Practice B	Type 304, 304L, 316, and 310L	0.0040
Practice C	Type 304L	.0020
Practice C	Type 430A	.0060

Type 304L and Type 316L test specimens must be given a sensitizing treatment prior to testing. (A typical sensitizing treatment is 1 hour at 1250 °F.)

(e) Nickel plate: Nickel plate must comply with the following specification:

Specifications	Minimum tensile strength (psi) welded condition[1]	Minimum elongation in 2 inches (per cent) welded condition (longitudinal)
ASTM B 162-69[2]	40,000	20

[1]Maximum stresses to be used in calculations.
[2]When used as cladding for carbon steel plate, low carbon nickel is required.

(f) Manganese-molybdenum steel plate: Manganese-molybdenum steel plate must be suitable for fusion welding and comply with the following specification:

Specifications	Minimum tensile strength (psi) welded condition[1]	Minimum elongation in 2 inches (per cent) welded condition (longitudinal)
ASTM A 302-69a, Gr. B	80,000	20

[1]Maximum stresses to be used in calculations.

(g) All parts and items of construction in contact with the lading must be made of material compatible with plate material and not subject to rapid deterioration by the lading, or be coated or lined with suitable corrosion resistant material.

(h) All external projections which may be in contact with the lading and all castings, forgings, or fabrications used for fittings or attachments to tank and expansion dome, when used, in contact with lading must be made of material to an approved specification. See AAR Specifications for Tank Cars, Appendix M, M4.05 for approved material specifications for castings for fittings.

§ 79.200-8 Tank heads. (a) All external tank heads must be an ellipsoid of revolution in which the major axis must equal the diameter of the shell and the minor axis must be one-half the major axis.

(b) Internal compartment tank heads may be 2:1 ellipsoidal, 3:1 ellipsoidal, or flanged and dished to thicknesses as specified in § 79.200-6. Flanged and dished heads must have main inside radius not exceeding 10 feet, and inside knuckle radius must not be less than 3¾ inches for steel, alloy steel, or nickel tanks, and not less than 5 inches for aluminum alloy tanks.

(c) (Cancelled).

§ 79.200-9 Compartment tanks. (a) When a tank is divided into compartments, by inserting interior heads, interior heads must be inserted in accordance with AAR Specifications for Tank Cars, Appendix E, E7.00, and must comply with the requirements specified in § 79.201-1. Voids between compartment heads must be provided with at least one tapped drain hole at their lowest point, and a tapped hole at the top of the tank. Top hole must be closed, and the bottom hole may be closed, with not less than three-fourths inch nor more than 1½-inches solid pipe plugs having NPT threads.

(b) When the tank is divided into compartments by constructing each compartment as a separate tank, these tanks shall be joined together by a cylinder made of plate, having a thickness not less than that required for the tank shell and applied to the outside surface of the tank head flanges. The cylinder shall fit the straight flange portion of the compartment tank head tightly. The cylinder shall contact the head flange for a distance of at least two times the plate thickness or a minimum of 1 inch whichever is greater. The cylinder shall be joined to the head flange by a full fillet weld. Distance from head seam to cylinder shall not be less than 1½ inches or three times the plate thickness, whichever is greater. Voids created by the space between heads of tanks joined together to form a compartment tank shall be provided with a tapped drainhole at their lowest point and a tapped hole at top of tank. The top hole shall be closed and the bottom hole may be closed with solid pipe plugs not less than ¾ inch nor more than 1½ inches having NPT threads.

§ 79.200-10 Welding. (a) All joints shall be fusion welded in compliance with the requirements of AAR Specifications for Tank Cars, Appendix W. Welding procedures, welders and fabricators shall be approved.

(b) Welding is not permitted on or to ductile iron or malleable iron fittings.

§ 79.200-11 Postweld heat treatment After welding is complete, postweld heat treatment must be in compliance with the requirements of AAR Specifications for Tank Cars, Appendix W, when specified in § 79.201-1.

§ 79.200-12 Tank mounting. See § 79.10.

§ 79.200-13 Manhole ring or flange, safety device flange, bottom outlet nozzle flange, bottom washout nozzle flange and other detachments and openings. (a) For steel and aluminum tanks, these attachments shall be riveted or fusion-welded.

(b) For alloy steel and nickel tanks these attachments shall be fusion-welded.

(c) Fusion-welding for securing these attachments in place shall be of the double-welded butt joint type or double full-fillet lap joint type.

(d) Rivets, if used, must comply with AAR Specification M-110-64 or its equivalent, must be compatible with plate material, and must meet the following additional requirements:

(1) Riveted joints shall be made metal to metal without interposition of other material.

(2) Rivets shall be driven hot and caulked inside. All joints formed by all riveted attachments shall be caulked inside. Split caulking is prohibited.

(3) Use of rivets less than ⅝ inch nominal diameter prohibited.

(4) For computing rivet areas the effective diameter of a driven rivet is the diameter of its reamed hole, which hole shall in no case exceed nominal diameter of rivet by more than 1/16 inch.

(5) When attachments are applied by means of riveting, the edges of plates shall be bevelled so that the angle of the caulking edge will be between 60 and 70 degrees with the flat surface of the attachment. The extreme caulking edge distance, measured from centre line of rivet hole, shall be at least one and one-half times the diameter of the hole and not more than that distance plus ¼ inch.

(6) Rivets shall be handled and driven in a manner that will insure requisite strength.

(e) The opening in the manhole ring shall be at least 16 inches in diameter except that acid resistant lined manholes shall be at least 18 inches in diameter before lining.

(f) Manhole ring or flange, if riveted to dome or tank, shall be of cast, forged or fabricated steel, malleable iron or other malleable metals.

(g) Manhole ring or flange, if welded to dome, tank or nozzle, shall be made of cast, forged or fabricated metal and be of good weldable quality in conjunction with metal of dome, tank, or nozzle.

(h) Openings for manholes or other fittings shall be reinforced in an approved manner.

§ 79.200-14 Expansion capacity. (a) Tanks shall have expansion capacity as prescribed in § 79.201-1. This capacity shall be provided in the tank for Class 111A cars, or in a dome for Class 103 and 104 type cars.

(b) The capacity of the expansion dome, when used, shall be at least the percentage specified in § 79.201-1 of the total capacity of the tank and dome combined. The capacity of the dome shall be measured from the inside top of shell of tank to the inside top of dome or bottom of any vent pipe projecting inside of dome, except that when safety relief device is applied to side of dome, the effective capacity of the dome shall be measured from top of safety relief device opening inside of dome to inside top of shell of tank.

(c) The opening in the tank shell within the dome shall be at least 29 inches in diameter. When the opening in the tank shell exceeds 30 inches in diameter, the opening shall be reinforced in an approved manner. When the opening in the tank shell is less than the inside diameter of the dome, and the dome pocket is not closed off in an approved manner, dome pocket drain holes shall be provided in the tank shell with nipples projecting inside the tank at least 1 inch.

(d) The dome head shall be of approved contour and shall be designed for pressure on concave side.

(e) Aluminum alloy domes:

(1) The dome shell thickness shall be calculated by the formula in § 79.200-6 (a).

(2) The dome head may be an ellipsoid of revolution in which the major axis shall be equal to the diameter of the dome shell and the minor axis shall be one-half the major axis. The thickness in this case shall be determined by using

formula in § 79.200-6(a).

(3) The dome head, if dished, must be dished to a radius not exceeding 96 inches. Thickness of dished dome head must be calculated by the formula § 79.200-6(c).

(4) Tank shell shall be reinforced by the addition of a plate equal to or greater than shell in thickness and the cross sectional area shall exceed metal removed for dome opening, or tank shell shall be reinforced by a seamless saddle plate equal to or greater than shell in thickness and butt welded to tank shell. The reinforcing saddle plate shall be provided with a flued opening having a vertical flange of the diameter of the dome for butt welding shell of dome to the flange. The reinforcing saddle plate shall extend about the dome a distance measured along shell of tank at least equal to the extension at top of tank. Other approved designs may be used.

(f) For thickness of carbon or alloy steel domes, see § 79.201-2.

§ 79.200-15 Closures for manholes. (a) Manhole covers shall be of approved type. See § 79.202-1 for special requirements for flammable liquids.

(b) Manhole covers shall be designed to provide a secure closure of the manhole.

(c) Manhole covers must be of approved cast, forged, or fabricated metals. Malleable iron, if used, must comply with ASTM A47-68, Grade 35018. Cast iron manhole covers must not be used.

(d) All joints between manhole covers and their seats shall be made tight against leakage of vapour and liquid by use of gaskets of suitable material.

(e) For other manhole cover requirements see § 79.201-1.

§ 79.200-16 Gauging devices, top loading and unloading devices, venting and air inlet devices. (a) When installed, these devices shall be of an approved design which will prevent interchange with any other fixture, and be tightly closed. Unloading pipes shall be securely anchored within the tank. Each tank or compartment may be equipped with one separate air connection.

(b) When the characteristics of the commodity for which the car is authorized are such that these devices must be equipped with valves or fittings to permit the loading and unloading of the contents, these devices, including valves, shall be of an approved design, and be provided with a protective housing except when plug or ball type valves with operating handles removed are used. Provision shall be made for closing pipe connection of valves.

(c) A tank may be equipped with a vacuum relief valve of an approved design. Protective housing is not required.

(d) When gauging device is required in § 79.201-1, an outage scale visible through manhole opening shall be provided. If loading devices are applied to permit tank loading with cover closed, a tell-tale pipe may be provided. Tell tale pipe shall be capable of determining that required outage is provided. Pipe shall be equipped with 1/4 inch maximum NPT control valve mounted outside tank and enclosed within a housing. Other approved devices may be used in lieu of outage scale or telltale pipe.

(e) Bottom of tank shell may be equipped with a sump or siphon bowl, or both, welded or pressed into the shell. Such sumps or siphon bowls, if applied, are not limited in size and must be made of cast, forged, or fabricated metal. Each sump or siphon bowl must be of good welding quality in conjunction with the metal of the tank shell. When sump or siphon bowl is pressed in the bottom of the tank shell, the wall thickness of the pressed section must not be less than that specified for the shell. The section of a circular cross section tank to which a sump or siphon bowl is attached need not comply with the out-of-roundness requirement specified in Appendix W, W14.06, of the AAR Specification for Tank Cars. Any portion of a sump or siphon bowl not forming a part of a cylinder of revolution must have walls of such thickness and be so reinforced that the stresses in the walls caused by a given internal pressure are not greater than the curcumferential stress which would exist under the same internal pressure in the wall of a tank of circular cross section designed in accordance with § 79.200-6 (a) and (d). In no case shall the wall thickness be less than that specified in § 79.201-1(a).

(f) When top loading and discharge devices, or venting and air inlet devices are installed with exposed piping to a removed location, shutoff valves must be applied directly to reinforcing pads or nozzles at their communication through the tank shell, and must be enclosed in a protective housing with provision for a seal. The piping must include breakage grooves, and suitable bracing. Relief valves must be applied to liquid lines for protection in case lading is trapped. Provision must be made to insure closure of the valves while the car is in transit.

(g) Protective housing, when required, must be fabricated of approved material and have cover and side-walls not less than 0.119 inch in thickness.

§ 79.200-17 Bottom outlets. (a) If indicated in § 79.201-1, tank may be equipped with bottom outlet. Bottom outlet, if applied, must comply with the following requirements:

(1) On newly built empty cars with truck centres through 60 feet, 6 inches, the extreme projection of the bottom outlet equipment must be at least 12 inches above the top of rail on level track. On cars with truck centres greater than 60 feet, 6 inches, the minimum rail clearance must be in accordance with the graph in Appendix E of the AAR Specifications for Tank Cars. All bottom outlet reducers and closures and their attachments must be secured to car by at least 3/8-inch chain or its equivalent, except that outlet closure plugs may be attached by 1/4-inch chain. When the bottom outlet closure is of the combination cap and valve type, the pipe connection to the valve must be closed by a plug, cap, or approved quick coupling device.

(2) Bottom outlet must be of approved construction, and be provided with a liquid-tight closure at its lower end.

(3) On cars with centre sills, a ball valve may be welded to the outside bottom of the tank or mounted on a pad or nozzle with a tongue and groove or male and female flange attachment. In no case shall the breakage groove or equivalent extend below the bottom flange of the centre sill. On cars without continuous centre sills, a ball valve may be welded to the outside bottom of the tank or mounted with a tongue and groove or male and female flange attachment on a pad attached to the outside bottom of the tank. The mounting pad must have a maximum thickness of 2 1/2 inches measured on the longitudinal centreline of the tank. The valve operating mechanism must be provided with a suitable locking arrangement to insure positive closure during transit.

(4) The valve operating mechanism for valves applied to the interior of the tank, and outlet nozzle construction, must insure against the unseating of the valve due to stresses or shocks incident to transportation.

(5) Bottom outlet nozzle of interior valves and the valve body of exterior valves, must be of cast, fabricated, or forged metal. If welded to tank, they must be of good weldable quality in conjunction with metal of tank.

(6) To provide for the attachment of unloading connections, the bottom of the main portion of the outlet nozzle or valve body of exterior valves, or some fixed attachment thereto, must be provided with threaded cap closure arrangement or bolted flange closure arrangement having minimum 1-inch threaded pipe plug or approved quick-coupling device. When two piece quick-coupling devices (i.e., adapter and dust cap) are used on bottom outlet extensions, an inline auxiliary valve must be applied between the bottom outlet valve and the quick-coupling closure. The quick-coupling closure (dust cap) or outlet nozzle wall must be fitted with a minimum 1-inch threaded plug. The auxiliary valve and dust cap may be omitted when the quick-coupling adapter is threaded internally and fitted with a minimum 1-inch plug.

(7) If outlet nozzle extends 6 inches or more from shell of tank, a "V" groove must be cut (not cast) in the upper part of outlet nozzle at a point immediately below lowest part of valve to a depth that will leave thickness of nozzle wall at the root of the "V" not over one-fourth of an inch. The outlet nozzle on interior valves or the valve body on exterior valves may be steam jacketed, in which case the breakage groove or its equivalent must be below the steam chamber but above the bottom of centre sill construction. If outlet nozzle is not a single piece, or if exterior valves are applied, provision must be made for the equivalent of the breakage groove. On cars without continuous centre sills, the breakage groove or its equivalent must be not more than 15 inches below the tank shell. On cars with continuous centre sills the breakage groove or its equivalent must be above the bottom of the centre sill construction.

(8) The flange on the outlet nozzle or the valve body of exterior valves must be of a thickness which will prevent distortion of the valve seat or valve by any change in contour of the shell resulting from expansion of lading, or other causes, and which will insure that accidental breakage of the outlet nozzle will occur at or below the "V" groove, or its equivalent.

(9) The valve must have no wings or stem projecting below the "V" groove or its equivalent. The valve and seat must be readily accessible or removeable for repairs, including grinding.

(10) The valve operating mechanism on interior valves must have means for compensating for variation in the vertical diameter of the tank produced by expansion, weight of the liquid contents, or other causes, and may operate from the interior of the tank, but in the event the rod is carried through the dome, or tank shell, leakage must be prevented by packing in stuffing box or other suitable seals and a cap.

(b) If indicated in § 79.201-1, tank may be equipped with bottom washout of approved construction. If applied, bottom washout shall be in accordance with the following requirements:

(1) On newly built empty cars with truck centres through 60 feet, 6 inches, the extreme projection of the bottom washout equipment must be at least 12 inches above the top of rail on level track. On cars with truck centres greater than 60 feet 6 inches, the minimum rail clearance must be in accordance with the graph in Appendix E of the AAR Specifications for Tank Cars.

(2) Bottom washout shall be of cast, forged or fabricated metal. If welded to tank they shall be of good weldable quality in conjuction with metal of tank.

(3) If washout nozzle extends 6 inches or more from shell of tank, a "V" groove must be cut (not cast) in the upper part of the nozzle at a point immediately below the lowest part of inside closure seat or plug to a depth that will leave wall thickness of nozzle at the root of the "V" not over one-fourth inch. Where nozzle is not a single piece, provision must be made for the equivalent of the breakage groove. The nozzle must be of a thickness to insure that accidental breakage will occur at or below the "V" groove or its equivalent. On cars without continuous centre sills, the breakage groove or its equivalent must not be more than 15 inches below the tank shell. On cars with continuous centre sills the breakage groove or its equivalent must be above the bottom of the centre sill construction.

(4) The closure plug and seat must be readily accessible or removable for repairs, including grinding.

(5) The closure of the washout nozzle must be equipped with a 3/4-inch solid screw plug. Plug must be attached by at least 1/4-inch chain.

(6) Joints between closures and their seats may be gasketed with suitable material.

§ 79.200-18 Safety relief devices. (a) Safety relief valves.

(1) When permitted in § 79.201-1, each tank or compartment shall be equipped with one or more safety relief valves of approved design, made of metal not subject to rapid deterioration by the lading, and mounted on expansion dome of Class 103 or 104 cars or top of tank shell of Class 111A cars. Total valve discharge capacity shall be sufficient to prevent building up of pressure in the tank to more than 10 psi, above start-to-discharge pressure. See AAR Specifications for Tank Cars, Appendix A, for formula for calculating discharge capacity.

(2) The start-to-discharge pressures and vapour tight pressures shall comply with § 79.201-1.

(b) Safety vents:

(1) When permitted in 79.201-1, each tank or compartment used for the transportation of corrosive liquids, flammable solids, oxidizing materials, or poisonous liquids or solids, need not be equipped with safety relief valves, but if not so equipped, shall have one safety vent at least 44.45 mm (1 3/4 inches) inside diameter, of an approved design which will present interchange with fixtures prescribed in 79.200-16(a), and closed with a frangible disc of lead or other approved material of a thickness that will rupture at not more than 100 percent of tank test pressure. Means for holding disc in place shall be such as to prevent distortion or damage to disc when applied. Safety vent closure shall be chained or otherwise fastened to prevent misplacement. All tanks equipped with vents shall be stencilled "NOT FOR FLAMMABLE LIQUIDS—LIQUIDES INFLAMMABLES INTERDITS"

§ 79.200-19 Reinforcements, when used, and appurtenances not otherwise specified. (a) All attachments to tank

and dome shall be applied by approved means. Rivets if used shall be caulked inside and outside.

(b) Reinforcing pads must be used between external brackets and shells if the attachment welds exceed 6 lineal inches of 1/4-inch fillet or equivalent weld per bracket or bracket leg. When reinforcing pads are used, they must not be less than one-fourth inch in thickness, have each corner rounded to a 1 inch minimum radius and be attached to the tank by continuous fillet welds except for venting provisions. The ultimate shear strength of the bracket to reinforcing pad weld must not exceed 85 percent of the ultimate shear strength of the reinforcing pad to tank weld.

§ 79.200-20 Interior heater systems. (a) See § 79.12.

§ 79.200-21 Closures for openings. (a) All plugs shall be solid, with NPT threads, and shall be of a length which will screw at least 6 threads inside the face of fitting or tank. Plugs, when inserted from the outside of tank heads, shall have the letter "S" at least 3/8 inch in size stamped with steel stamp or cast on the outside surface to indicate the plug is solid.

§ 79.200-22 Test of tanks. (a) Each tank shall be tested by completely filling the tank and dome or nozzles with water, or other liquid having similar viscosity, of a temperature which shall not exceed 100°F. during the test; and applying the pressure prescribed in § 79.201-1. Tank shall hold the prescribed pressure for at least 10 minutes without leakage or evidence of distress. All rivets and closures, except safety relief valves or safety vents, shall be in place when test is made.

(b) Insulated tanks shall be tested before insulation is applied.

(c) Rubber-lined tanks shall be tested before rubber lining is applied.

(d) Caulking of welded joints to stop leaks developed during the foregoing tests is prohibited. Repairs in welded joints shall be made as prescribed in AAR Specification for Tank Cars Appendix W.

§ 79.200-23 Tests of safety relief valves. (a) Each valve shall be tested by air or gas for compliance with § 79.201-1 before being put into service.

§ 79.200-24 Stamping. (a) To certify that the tank complies with all specification requirements, each tank shall be plainly and permanently stamped in letters and figures at least 3/8 inch high into the metal near the centre of both outside heads as follows:

	Example of required stamping
Specification	CTC-103-W
Material	ASTM A285C
Cladding Material (if any)	ASTM A240-304 CLAD
Tank Builders Initials	ABC
Date of Original Test	00-0000
Car Assembler (if other than tank builder)	DEF

(b) On Class 111 tank cars, the last numeral of the specification number may be omitted from the stamping; for example, 111A100W.

§ 79.200-25 Stencilling. (a) The tank, or the jacket if tank is insulated, shall be stencilled in compliance with the requirements of AAR Specifications for Tank Cars, Appendix C.

§ 79.200-26 Certificate of construction. (a) See § 79.5.

§ 79.201 Individual specification requirements applicable to non-pressure tank car tanks.

§ 79.201-1 Individual specification requirements. (a) In addition to § 79.200 the individual specification requirements are as follows:

CTC specifications	103A-ALW	103AW	103ALW	103ANW	103BW	103CW	103DW	103EW
Material (see 79.200-7)	Al alloy	Steel	Al alloy	Nickel	Steel	Alloy steel	Alloy steel	Alloy steel
Insulation (see 79.200-4)	Optional	Optional	Optional	Optional	Optional	Optional	Optional	Optional
Bursting pressure psi. (See 79.200-5)	240	240	240	240	240	240	240	240
Minimum Plate thickness inches:								
Shell (see 79.200-6)	1/2	79.201-2	1/2	79.201-2	79.201-2	79.201-2	79.201-2	79.201-2
Heads (see 79.200-6 and 79.200-8)	1/2	79.201-2	1/2	79.201-2	79.201-2	79.201-2	79.201-2	79.201-2
Dome	Required	Required	Required	Required	Required	Required	Required	Required
Minimum expansion capacity (see 79.200-14)	1 per cent in dome	1 per cent in dome	2 per cent in dome	1 per cent in dome	1 per cent in dome	1 per cent in dome	2 per cent in dome	1 per cent in dome
Test pressure psi. (See 79.200-22)	60	60	60	60	60	60	60	60
Safety relief devices (see 79.200-18)	Valve or vent	79.201-7	Valve or vent	79.201-7	Vent	Valve	Valve or vent	Valve or vent
Valve start-to-discharge pressure psi. (±3 psi)	35	35	35	35		35	35	35
Valve vapour tight pressure (minimum psi.)	28	28	28	28		28	28	28
Valve flow rating pressure (maximum psi.)	45	45	45	45		45	45	45
Vent bursting pressure (maximum psi.)	60	60	60	60	60	Prohibited	60	60
Gauging devices (see 79.200-16)	Optional	Optional	Optional	Optional	Optional	Optional	Optional	Optional
Top loading and unloading devices (see 79.200-16a)	Required (valves optional)	Required (valves optional)	Optional	Required (valves optional)	Required (valves optional)	Required (valves optional)	Optional	Required (valves optional)
Bottom outlet (see 79.200-17a)	Prohibited	Prohibited	Optional	Prohibited	Prohibited	Prohibited	Optional	Prohibited
Bottom washout (see 79.200-17b)	Optional	Optional	Optional	Optional	Prohibited	Prohibited	Optional	Optional
Closure for manhole (see 79.200-16)			79.201-6(a)	79.201-6(d)	79.201-6(b)	79.201-6(c)	79.201-6(a) 79.201-6(c)	79.201-6(c)
Postweld heat treatment (HT) (see 79.200-11)	Prohibited	HT 79.202-6	Prohibited	Not required	HT	HT 79.201-5	HT 79.201-5	HT 79.201-5
Special references	79.202-10	79.202-7	79.202-1	79.202-8	79.201-3	79.201-4	79.201-4	79.201-4
	79.202-14	79.202-8	79.202-21	79.202-11	79.202-9	79.202-14	79.202-1	79.202-11
	79.202-21	79.202-11		79.202-15	79.202-12	79.202-15		79.202-15
		79.202-12		79.202-17		79.202-19		
		79.202-13				79.202-21		
		79.202-16						
		79.202-17						
		79.202-20						
		79.202-22						

CTC specifications	103W	104W	111A60ALW1	111A60ALW2	111A60W1[1]	111A60W2	111A60W5	111A60W7
Material (see 79.200-7)	Steel	Steel	Al alloy	Al alloy	Steel	Steel	Steel	Alloy steel
Insulation (see 79.200-4)	Optional	Optional	Optional	Optional	Optional	Optional	Optional	Optional
Bursting pressure psi. (See 79.200-5)	240	240	240	240	240	240	240	240
Minimum Plate thickness inches:								
Shell (see 79.200-6)	79.201-2	79.201-2	1/2	1/2	7/16	7/16	7/16	7/16
Heads (see 79.200-6 and 79.200-8)	79.201-2	79.201-2	1/2	1/2	7/16	7/16	7/16	7/16
Dome	Required	Required	None	None	None	None	None	None
Minimum expansion capacity (see 79.200-14)	2 per cent in dome	2 per cent in dome	2 per cent in tank	2 per cent in tank	2 per cent in tank	2 per cent in tank	2 per cent in tank	2 per cent in tank
Test pressure psi. (See 79.200-22)	60	60	60	60	60	60	60	60
Safety relief devices (see 79.200-18)	Valve or vent	Valve or vent	Valve or vent	Valve or vent	Valve or vent	79.201-7	Vent	Valve or vent
Valve start-to-discharge pressure psi. (±3 psi)	35	35	35	35	35	35		35
Valve vapour tight pressure (minimum psi.)	28	28	28	28	28	28		28
Valve flow rating pressure (maximum psi.)	45	45	45	45	45	45		45
Vent bursting pressure	60	60	60	60	60	60	60	60
Gauging devices (see 79.200-16)	Optional	Optional	Required	Required	Required	Required	Required	Optional
Top loading and unloading devices (see 79.200-16)	Optional	Optional	Optional	Required (valves optional)	Optional	Required (valves optional)	Required (valves optional)	Required (valves optional)
Bottom outlet (see 79.200-17(a))	Optional	Optional	Optional	Prohibited	Optional	Prohibited	Prohibited	Prohibited
Bottom washout (see 79.200-17(b)	Optional	Optional	Optional	Optional	Optional	Optional	Prohibited	Prohibited
Closure for manhole (see 79.200-15)	79.201-6(a)	79.201-6(a)	79.201-6(a)	79.201-6(a)	79.201-6(a)	79.201-6(a)	79.201-6(b)	79.201-6(c)
Postweld heat treatment (HT) (see 79.200-11)	HT	HT	Prohibited	Prohibited	HT	HT	HT	HT 79.201-5
Special references	79.202-1 79.202-2 79.202-3 79.202-4 79.202-5 79.202-6 79.202-19	79.202-1	79.202-1	79.202-21	79.202-2 79.202-3 79.202-5 79.202-6	79.201-3		79.201-4 79.202-21

CTC specifications	111A100ALW	111A100ALW2	111A100W1[1]	111A100W2[1]	111A100W3	111A100W4	111A100W5	111A100W6	111A60F1,[1] 111A100F1,[1] 111A100F2[1]
Material (see 79.200-7)	Al alloy	Al alloy	Steel	Steel	Steel	Steel	Steel	Alloy steel	
Insulation (see 79.200-4	Optional	Optional	Optional	Optional	Required	Required	Optional	Optional	
Bursting pressure psi. (See 79.200-5)	500	500	500	500	500	500	500	500	
Minimum plate thickness inches:									
Shell (see 79.200-6)	5/8	5/8	7/16	7/16	7/16	7/16	7/16	7/16	
Heads (see 79.200-6 and 79.200-8)	5/8	5/8	7/16	7/16	7/16	7/16	7/16	7/16	
Dome	None	None	None	None	None	None	None	None	
Minimum expansion capacity (see 79.200-14)	2 per cent in tank	2 per cent in tank	2 per cent in tank	2 per cent in tank	2 per cent in tank	Footnote 2	2 per cent in tank	2 per cent in tank	
Test pressure psi. (See 79.200-22)	100	100	100	100	100	100	100	100	
Safety relief devices (see 79.200-18)	Valve or vent	Valve or vent	Valve or vent	79.201-7	Valve or vent	Valve	Vent	Valve or vent	
Valve start-to-discharge pressure psi. (±3 psi)	75	75	75	75	75	75		75	
Valve vapour tight pressure (minimum psi.)	60	60	60	60	60	60		60	
Valve flow rating pressure (maximum psi.)	85	85	85	85	85	85		85	
Vent bursting pressure	100	100	100	100	100	Prohibited	100	100	
Gauging devices (see 79.200-16)	Required	Required	Required	Required	Required	Required	Required	Required	
Top loading and unloading devices (see 79.200-16)	Optional	Required (valves optional	Optional	Required (valves optional	Optional (if used, valves required)	Required (valves required	Required (valves optional)	Optional (if used, valves required)	
Bottom outlet (see 79.200-17(a)	Optional	Prohibited	Optional	Prohibited	Optional	Prohibited	Prohibited	Optional	
Bottom washout (see 79.200-17(b)	Optional	Optional	Optional	Optional	Optional	Prohibited	Prohibited	Optional	
Closure for manhole (see 79.200-15)	79.201-6(a)		79.201-6(a)		79.201-6(a)	79.201-6(a)	79.201-6(b)	79.201-6(a) 79.201-6(c)	
Postweld heat treatment (HT) (see 79.200-11)	Prohibited	Prohibited	HT	HT	HT	HT	HT	HT 79.201-5	
Special reference		79.202-21	79.202-1 79.202-2 79.202-5 79.202-6	79.202-6 79.202-7 79.202-8 79.202-11 79.202-12 79.202-13 79.202-16 79.202-17 79.202-20 79.202-22	79.202-1	79.201-8 79.201-10 79.202-1 79.202-19 79.202-20	79.201-3 79.202-9 79.202-12	79.201-4 79.202-1 79.202-14	

[1]Tanks converted to CTC-111A series from existing forge-welded specification. CTC-105A300, 400, or 500 tanks, by modification using conversion details complying with CTC-111A specification requirements, shall be stencilled by substituting the letter "F" for the letter "W" in the specification designation.
[2]See 73.314(c) for compressed gases and 73.116 for flammable liquids, unless otherwise specified in Part 73 Subpart C.

§ 79.201-2 Minimum plate thickness. (a) The minimum plate thickness after forming must be as follows:

Inside diameter of tanks	Bottom sheets (inch)	Shell sheets (inch)	Expansion dome sheets (inch)	2:1 Ellipsoidal heads (inch)	3:1 Ellipsoidal and dished tank heads (inch)	Expansion dome heads (inch)	Interior compartment heads (inch)
60 inches or under	7/16	1/4	5/16	7/16	1/2	5/16	5/16
Over 60 to 78 inches	7/16	5/16	5/16	7/16	1/2	5/16	5/16
Over 78 to 96 inches	1/2[1]	3/8	5/16	7/16	1/2	5/16	3/8
Over 96 to 112 inches	1/2[1]	7/16	5/16	7/16	9/16	5/16	7/16
Over 112 to 122 inches	1/2	1/2	5/16	1/2	5/8	5/16	1/2

[1]May be reduced to 7/16 inch when approved steels having tensile strength of 65,000 psi. or higher are used

§ 79.201-3 Lined tanks. (a) Rubber-lined tanks.

(1) Each tank or each compartment thereof must be lined with acid-resistant rubber or other approved rubber compound vulcanized or bonded directly to the metal tank, to provide a nonporous laminated lining, at least 5/32-inch thick, except overall rivets and seams formed by riveted attachments in the lining must be double thickness. The rubber lining must overlap at least 1 1/2 inches at all edges which must be straight and be beveled to an angle of approximately 45°, or butted edges of lining must be sealed with a 3-inch minimum strip of lining having 45° beveled edges.

(2) As an alternate method, the lining may be joined with a skived butt seam then capped with a separate strip of lining 3 inches wide having 45° beveled edges. An additional rubber reinforcing pad at least 4 1/2 feet square and at least 1/2-inch thick must be applied by vulcanizing to the lining on bottom of tank directly under the manhole opening. The edges of the rubber pad must be beveled to an angle of approximately 45°. An opening in this pad for sump is permitted. No lining must be under tension when applied except due to conformation over rivet heads. Interior of tank must be free from scale, oxidation, moisture, and all foreign matter during the lining operation.

(3) Other approved lining materials may be used provided the material is resistant to the corrosive or solvent action of the lading in the liquid or gas phase and is suitable for the service temperatures.

(b) Before a tank car tank is lined with rubber, or other rubber compound, a report certifying that the tank and its equipment have been brought into compliance with spec. 103B, 103BW, 111A60W5, or 111A100W5 must be furnished by car owner to the party who is to apply the lining. A copy of this report in approved form, certifying that tank has been lined in compliance with all requirements of one of the above specifications, must be furnished by party lining tank to car owner. Reports of the latest lining application must be retained by the car owner until the next relining has been accomplished and recorded.

(c) All rivet heads on inside of tank must be button-head, or similar shape, and of uniform size. The under surface of heads must be driven tight against the plate. All plates, castings and rivet heads on the inside of the tank must be caulked. All projecting edges of plates, castings and rivet heads on the inside of the tank must be rounded and free from fins and other irregular projections. Castings must be free from porosity.

(d) All surfaces of attachments or fittings and their closures exposed to the lading must be covered with at least 1/8-inch acid resistant material. Attachments made of metal not affected by the lading need not be covered with rubber or other acid resistant material.

(e) Hard rubber or polyvinyl chloride may be used for pressure retaining parts of safety vents provided the material is resistant to the corrosive or solvent action of the lading in the liquid or gas phase and is suitable for the service temperatures.

(f) Polyvinyl chloride lined tanks. Tank car tanks or each compartment thereof may be lined with elastomeric polyvinyl chloride having a minimum lining thickness of three thirty-seconds inch.

(g) Polyurethane lined tanks. Tank car tanks or each compartment thereof may be lined with elastomeric polyurethane having a minimum lining thickness of one-sixteenth inch.

§ 79.201-4 Material. All fittings, tubes, and castings and all projections and their closures, except for protective housing, must also meet the requirements specified in AAR Specifications for Tank Cars, Appendix M, M3.03(b) and M4.05(d).

§ 79.201-5 Postweld heat treatment and corrosion resistance. (a) Tanks and attachments welded directly thereto must be postweld heat treated as a unit at the proper temperature except as indicated below. Tanks and attachments welded directly thereto fabricated from ASTM A240-70 Type 430A, Type 304 and Type 316 materials must be postweld heat treated as a unit and must be tested to demonstrate that they possess the corrosion resistance specified in § 79.200-7(d), Footnote 2. Tanks and attachments welded directly thereto, fabricated from ASTM A240-70 Type 304L or Type 316L materials are not required to be postweld heat treated.

(b) Tanks and attachments welded directly thereto, fabricated from ASTM A240-70 Type 304L and Type 316L materials must be tested to demonstrate that they possess the corrosion resistance specified in § 79.200-7(d), Footnote 2.

§ 79.201-6 Manhole and manhole closures. (a) The manhole cover for spec. 103ALW, 103DW, 103W, 104W, 111A60ALW1, 111A60W1, 111A100ALW1, 111A100W1, 111A100W3, or 111A100W6 must be designed to make it impossible to remove the cover while the interior of the tank is subjected to pressure.

(b) The manhole cover for spec. 103BW, 111A60W5, or 111A100W5 must be made of a suitable metal. The top, bottom and edge of manhole cover must be acid resistant material covered as prescribed in § 79.201-3. Through-bolt holes must be lined with acid resistant material at least one-eighth inch in thickness. Cover made of metal not affected by the lading need not be acid resistant material covered.

(c) The manhole ring and cover for spec. 103CW, 103DW, 103EW, 111A60W7, or 111A100W6 must be made of the metal and have the same inspection procedures specified in AAR Specifications for Tank Cars Appendix M, M3.03.

(d) The manhole ring for 103ANW must be made of cast, forged or fabricated nickel and be a good weldable quality in conjunction with the metal of the dome. Manhole cover must be made of nickel.

§ 79.201-7 Safety relief devices. (a) Each tank or compartment must be equipped with a safety vent unless characteristics of the lading require a safety relief valve. These devices must comply with § 79.200-18.

(b) Safety vents, if used, shall be of approved design, at least 1¾ inches inside diameter, made of material not subject to rapid deterioration by the lading, and closed with a frangible disc of lead or other approved material of a thickness that will burst at not more than 75 per cent of tank test pressure. Means for holding the disc in place shall be such as to prevent distortion or damage to disc when applied. Safety vent closure shall be chained or otherwise fastened to prevent misplacement.

(c) Safety relief valves, if used, shall be of approved design, made of metal not subject to rapid deterioration by the lading, and mounted on expansion dome of Class 103 and 104 type tanks, or top or tank shell for Class 111A type tanks.

§ 79.201-8 Sampling device and thermometer well. (a) Sampling valve and thermometer well are not specification requirements. When used, they must be of approved design, made of metal not subject to rapid deterioration by lading, and must withstand a pressure of 100 pounds per square inch without leakage. Interior pipes of the sampling valve must be equipped with excess flow valves of an approved design. Interior pipe of thermometer well must be closed by an approved valve attached close to fitting where it passes through the tank and closed by a screw plug. Other approved arrangements that permit testing thermometer well for leaks without complete removal of the closure may be used.

§ 79.201-9 Gauging device. (a) A gauging device of an approved design must be applied to permit determining the liquid level of the lading. The gauging device must be made of materials not subject to rapid deterioration by the lading. When the interior pipe of the gauging device provides a means for passage of the lading from the interior to the exterior of the tank, it must be equipped with an excess flow valve of an approved design. If the opening for passage of lading through the gauging device is not more than 0.060 inch diameter an excess flow valve is not required. The gauging device must be provided with a protective housing.

(b) An excess flow valve, as referred to in this specification, is a device which closes automatically against the outward flow of the contents of the tank such as may be encountered in case the external closure valve is broken off or removed during transit. Excess flow valves may be designed with a by-pass to allow equalization of pressures.

§ 79.201-10 Water Capacity marking. (a) Water capacity of the tank in pounds stamped plainly and permanently in letters and figures at least ⅜ inch high into the metal of the tank immediately below the stamped marks specified in § 79.200-24 (a). This mark shall also be stencilled on the jacket immediately below the dome platform and directly behind or within 3 feet of the right or left side of the ladder or ladders, if there is a ladder on each side of the tank, in letters and figures at least 1½ inches high as follows:

WATER CAPACITY

000000 Pounds

§ 79.201-11 Insulation. (a) Insulation shall be of sufficient thickness so that the thermal conductance at 60°F. is not more than 0.075 Btu. per hour, per square foot, per degree F. temperature differential.

§ 79.202 Special commodity requirements for non-pressure tank car tanks. (a) In addition to §§ 79.200 and 79.201 the following requirements are applicable:

§ 79.202-1 Flammable liquids not specifically provided for. Tank cars used to transport flammable liquids not specifically provided for must have manhole closures so designed that pressure will be released automatically by starting the operation of removing the manhole cover. Openings in tank heads to facilitate application of lining are authorized and must be closed in an approved manner. Specifications ARA-III, ARA-IV, and 103, 103W, 103ALW, 104, 104W, 111A60ALW1 or 111A100W3, used to transport flammable liquids not specifically provided for having a vapour pressure exceeding 27 pounds per square inch absolute at 100°F. but not exceeding 40 p.s.i.a. at 100°F., must have their manhole closures equipped with approved safeguards making removal of closures from the manhole opening practically impossible while car interior is subjected to vapour pressure of lading. These cars must be stencilled on each side of dome in line with the ladders, and in a colour contrasting to the colour of the dome with the identification mark as prescribed in AAR Specifications for Tank Cars. Appendix C.

§ 79.202-2 Dimethyl dichlorosilane, ethyl dichlorosilane, ethyl trichlorosilane, methyl trichlorosilane, trimethyl chlorosilane, vinyl trichlorosilane, methyl dichlorosilane and trichlorosilane. Tank cars used to transport dimethyl dichlorosilane, ethyl dichlorosilane, ethyl trichlorosilane, methyl trichlorosilane, trimethyl chlorosilane, vinyl trichlorosilane, methyl dichlorosilane and trichlorosilane must not be equipped with bottom discharge outlet.

§ 79.202-3 Amyl mercaptan, butyl mercaptan, ethyl mercaptan, isopropyl mercaptan, propyl mercaptan, and aliphatic mercaptan mixtures. Tank cars used to transport amyl mercaptan, butyl mercaptan, ethyl mercaptan, isopropyl mercaptan, propyl mercaptan, and aliphatic mercaptan mixtures must have bottom outlets effectively sealed. Bottom washout permitted.

§ 79.202-4 Fused Potassium nitrate and Sodium nitrite. (a) Spec. 103 tank cars used to transport potassium nitrate mixed (fused) with Sodium nitrite shall be specially designed, equipped and approved for this service, without bottom discharge outlet and with heavier plate thicknesses than the minimum prescribed for cars built under this specification. For spec. 103W tank cars made of plates having the minimum prescribed thicknesses, internal reinforcement of the upper sheets of the tank in the region of the dome and reinforcing plates attached to the bottom sheet of the tank which rests on bolsters is required, and these tanks shall be equipped with baffle plates. Heater pipes shall be of welded construction designed for a test pressure of 500 pounds per square inch. A one inch woven asbestos lining shall be placed between bolster slabbing and bottom of tank to prevent heat transmission. Safety vents of the frangible disc type may be used and if used the frangible discs shall be perforated with ⅛ inch hole.

If safety relief valves are used, a vacuum relief valve shall be installed on the dome.

§ 79.202-5 Phosphorus, white or yellow. Tank cars used to transport phosphorus, white or yellow, must be equipped with approved dome fittings, external heater systems and with insulation at least 4 inches in thickness, except that thickness of insulation may be reduced to 2 inches over external heater coils. Bottom washout nozzle of approved design may be applied. Bottom outlet for discharge of lading prohibited.

§ 79.202-6 Cumene hydroperoxide, diisopropylbenzene hydroperoxide and paramenthane hydroperoxide. Tank cars used to transport cumene hydroperoxide of strength not exceeding 90 per cent in a nonvolatile solvent, paramenthane hydroperoxide of strength not exceeding 60 per cent in a nonvolatile solvent and diisopropylbenzene hydroperoxide of strength not exceeding 60 per cent in a nonvolatile solvent, must have bottom outlets effectively sealed from the inside.

§ 79.202-7 Titanium tetrachloride, anhydrous. Tank cars used to transport titanium tetrachloride, anhydrous, must be equipped with safety relief valves. Safety vents not permitted.

§ 79.202-8 Chloracetyl chloride. Tank cars used to transport chloracetyl chloride must have a nickel cladding of 1/16-inch minimum thickness. Nickel cladding in tanks must have a minimum nickel content of at least 99 per cent pure nickel. Spec. 103ANW tank cars used to transport chloracetyl chloride must be of solid nickel at least 99 per cent pure and all cast metal parts of the tank in contact with the lading must have a minimum nickel content of 96.7 per cent.

§ 79.202-9 Hydrochloric (muriatic) acid, hydrochloric (muriatic) acid mixtures, hydrochloric (muriatic) acid solution, inhibited; sodium chlorite solution (not exceeding 42 per cent sodium chlorite); and cleaning compounds, liquid, containing hydrochloric (muriatic) acid. (a) For acids not over 38 per cent strength by weight, except hydrochloric (muriatic) acid of not over 22° Baume strength, tank cars may be equipped with safety vent of approved design having a frangible disc with 1/8-inch breather hole in the centre, or a safety vent of approved design using carbon discs permitting continuous venting.

(b) Sodium chlorite solution. Spec. 103CW tank cars having tanks of Type 304L stainless steel authorized for sodium chlorite solution not exceeding 42 per cent sodium chlorite only.

§ 79.202-10 Hydrogen peroxide solution in water exceeding 52 per cent by weight. (a) Tank cars used to transport hydrogen peroxide solution in water exceeding 52 per cent by weight, shall be equipped with a venting arrangement approved by the Bureau of Explosives through the Commission.

§ 79.202-11 Phosphorus oxybromide, phosphorus oxychloride, phosphorus trichloride, and thiophosphoryl chloride. Specification 103ANW tank cars used to transport phosphorus oxybromide, phosphorus oxychloride, phosphorus trichloride, and thiophosphoryl chloride must be solid nickel at least 99 per cent pure and all cast metal parts of the tank in contact with the lading have a minimum nickel content of approximately 96.7 per cent. Spec. 103A tank cars used to transport phosphorus trichloride must be lead-lined steel, or made of steel at least 10 per cent nickel clad. Spec. 103AW, 111A100F2, or 111A100W2 tank cars used to transport phosphorus trichloride must be lead-lined steel or made of steel with a minimum thickness of nickel cladding of one-sixteenth inch. Nickel cladding in tanks must have a minimum nickel content of at least 99 per cent pure nickel. Spec. 103EW tank cars used to transport phosphorus trichloride and thiophosphoryl chloride must have tanks fabricated from Type 316 stainless steel. Unlined spec. 103A, 103AW, 111A100F2, or 111A100W2 tank cars authorized for phosphorus trichloride only.

§ 79.202-12 Sulphuric acid of concentrations 65.25 per cent (approximately 1.559 specific gravity) (52° Baume) or greater. (a) Specifications 103A, 103AW, 111A100F2, or 111A100W2 tank cars used for this service may be equipped with safety vent of approved design having a frangible disc with 1/8-inch breather hole in the centre.

(b) Specifications 103A, 103AW, 111A100F2, or 111A100W2 tank cars used in oleum and other fuming acids must be equipped with safety vent of approved design. Breather hole in frangible disc prohibited. Safety valve prohibited.

§ 79.202-13 Sulphur trioxide, stabilized. Tank cars used to transport sulphur trioxide stabilized must be equipped with safety relief valves of approved design. Tanks equipped with interior heating coils not permitted.

§ 79.202-14 Anhydrous hydrazine and hydrazine solutions containing 50 per cent or less of water. (a) Tank cars used to transport anhydrous hydrazine or hydrazine solutions containing 50 per cent or less water, must have tanks fabricated of Type 304L stainless steel with molybdenum content not exceeding one-half of 1 per cent. Spec. 111A100W6 tanks must not be equipped with bottom outlet.

(b) Safety relief valves for spec. 103CW tank cars may have a start-to-discharge pressure of 45 psi. with a tolerance of plus or minus 3 psi. and a vapour tight pressure of 36 psi. Refer to AAR Specifications for Tank Cars Appendix A, A8.05.

(c)Spec. 103A-ALW tank cars authorized for transporting anhydrous hydrazine only, may have tanks equipped with a safety relief valve having start-to-discharge pressure of not more than 45 psi. with a tolerance of plus or minus 3 psi. and a vapour tight pressure of 36 psi. Refer to AAR Specifications for Tank Car Appendix A, A8.05.

§ 79.202-15 Formic acid and formic acid solutions. If a specification 103EW tank car is used it must be fabricated from type 316 stainless steel.

§ 79.202-16 Monochloracetic acid, liquid. Tank cars used to transport monochloracetic acid, liquid, must have tanks nickel clad at least 20 per cent.

(b) Monochloracetic acid, anhydrous, must be shipped in Spec. 103ANW tank car fabricated of 99 percent pure nickel or in 103AW or 111A60W2 tank car nickel-clad at least 20 per cent or be provided with a suitable corrosion resistant coating or lining.

§ 79.202-17 Benzyl chloride. Spec. 103ANW tank cars used to transport benzyl chloride must have all cast metal parts in contact with the lading made from metal having a minimum nickel content of 96.7 per cent.

§ 79.202-19 Dimethylhydrazine, unsymmetrical. Tank cars used to transport dimethylhydrazine, unsymmetrical, must be equipped with steel safety valves of approved design. Spec. 103W tank cars must not be equipped with bottom outlets.

79.202-20 Hydrofluoric acid. Breather hole in frangible disc prohibited.

§ 79.202-21 Nitric acid. (a) Tank cars used to transport nitric acid must comply with the following requirements:

(1) Bottom washout or bottom outlet is prohibited unless effectively sealed with an approved arrangement to prevent use during loading and unloading of acid.

(2) Safety vent is prohibited.

§ 79.202-22 Mixed acid (nitric and sulfuric acid) (nitrating acid). Spec. 103A, 103AW, 111A100F1, or 111A100W2 tank cars used in nitrating and other fuming acids service must be equipped with safety vent of approved design. Breather hole in frangible disc prohibited. Safety valve prohibited.

§ 79.220 General specifications applicable to non-pressure tank car tanks consisting of an inner container supported within an outer shell (class CTC-115).

§ 79.220-1 Tanks built under these specifications must meet the requirements of §§ 79.220 and 79.221.

§ 79.220-2 Approval. For procedures in securing approval, see § 79.3.

§ 79.220-3 Type. (a) Tanks built under these specifications must consist of an inner container, a support system for the inner container, and an outer shell.

(b) The inner container must be a fusion welded tank of circular cross section with formed heads designed convex outward and must have a manhole on top of the tank as prescribed herein. When the inner container is divided into compartments, each compartment must be considered a separate container.

(c) The outer shell must be a fusion welded tank with formed heads designed convex outward.

§ 79.220-4 Insulation. The annular space between the inner container and the outer shell must contain an approved insulation material.

§ 79.220-5 Bursting pressure. The minimum required bursting pressure of the inner container is listed in § 79.221-1.

§ 79.220-6 Thickness of plates. (a) The wall thickness, after forming of the inner container shell and 2:1 ellipsoidal heads must be not less than specified in § 79.221-1, or not less than that calculated by the following formula:

$$t = \frac{Pd}{2SE}$$

where:

d = Inside diameter in inches;
E = 0.9 welded joint efficiency; except E = 1.0 for seamless heads;
P = Minimum required bursting pressure in psi.;
S = Minimum tensile strength of plate material in psi. as prescribed in AAR Specifications for Tank Cars, Appendix M, Table M1;
t = Minimum thickness of plate in inches after forming.

(b) The wall thickness after forming of the inner container heads, if flanged and dished, must be not less than specified in § 79.221-1, or not less than that calculated by the following formula:

$$t = \frac{5PL}{6SE}$$

where:

E = 0.9 welded joint efficiency; except E = 1.0 for seamless heads;
L = Main inside radius to which head is dished, measured on concave side in inches;
P = Minimum required bursting pressure in psi.;
S = Minimum tensile strength of plate material in psi. as prescribed in AAR Specifications for Tank Cars, Appendix M, Table M1;
t = Minimum thickness of plate in inches after forming.

(c) The wall thickness after forming of the cylindrical section and heads of the outershell must be not less than seven-sixteenths inch.

(d) See § 79.220-9 for plate thickness requirements for inner container when divided into compartments.

§ 79.220-7 Materials. (a) The plate material used to fabricate the inner container and nozzles must meet one of the following specifications and with the indicated minimum tensile strength and elongation in the welded condition.

(b) Carbon steel plate: The maximum allowable carbon content must be 0.31 per cent when the individual specification allows carbon content greater than this amount. The plates may be clad with other approved materials.

Specifications	Minimum tensile strength (psi) welded condition[1]	Minimum elongation in 2 inches (per cent) welded condition (longitudinal)
ASTM A 515, Gr. 55	55,000	28
ASTM A 515, Gr. 60	60,000	25
ASTM A 515, Gr. 65	65,000	20
ASTM A 515, Gr. 70	70,000	20
ASTM A 285, Gr. A	45,000	29
ASTM A 285, Gr. B	50,000	20
ASTM A 285, Gr. C	55,000	20
ASTM A 516, Gr. 55	55,000	28
ASTM A 516, Gr. 60	60,000	25
ASTM A 516, Gr. 65	65,000	20
ASTM A 516, Gr. 70	70,000	20
AAR TC128, Gr. B	81,000	19

[1] Maximum stresses to be used in calculations.

(c) Aluminum alloy plate: Aluminum alloy plate must be suitable for welding and comply with one of the following specifications:

Specifications	Minimum tensile strength (psi) 0 temper welded condition[3,6]	Minimum elongation in 2 inches (per cent) 0 temper welded condition (longitudinal)
ASTM B209, Alloy 5052[1]	25,000	18
ASTM B209, Alloy 5083[2]	38,000	16
ASTM B209, Alloy 5086[1]	35,000	14
ASTM B209, Alloy 5154[1]	30,000	18
ASTM B209, Alloy 5254[1]	30,000	18
ASTM B209, Alloy 5454[1]	31,000	18
ASTM B209, Alloy 5652[1]	25,000	18
ASTM B209, Alloy 6061[4]	24,000[5]	5[5]

[1] For fabrication, the parent plate material may be 0, H112, or H32 temper, but design calculations must be based on the minimum tensile strength shown.
[2] 0 temper only.
[3] Weld filler metal 5556 must not be used.
[4] Not authorized for tank shells, manholes or domes.
[5] T6 temper only.
[6] Maximum stresses to be used in calculations.

(d) High alloy steel plate: High alloy steel plate must comply with one of the following specifications:

Specifications	Minimum tensile strength (psi) welded condition[1]	Minimum elongation in 2 inches (per cent) welded condition (longitudinal)
ASTM A240-70, Type 304	75,000	30
ASTM A240-70, Type 304L ...	70,000	30
ASTM A240-70, Type 316	75,000	30
ASTM A240-70, Type 316L ...	70,000	30

[1] Maximum stresses to be used in calculations.

(e) Manganese-molybdenum steel plate: Manganese-molybdenum steel plate must be suitable for fusion welding and must comply with the following specifications:

Specifications	Minimum tensile strength (psi) welded condition[1]	Minimum elongation in 2 inches (per cent) welded condition (longitudinal)
ASTM A302-70a, Gr. B	80,000	20

Maximum stresses to be used in calculations.

(f) Plate materials used to fabricate the outer shell and heads must be those listed in paragraphs (b), (c), (d), or (e) of this section. The maximum allowable carbon content must be 0.31 per cent when the individual specification allows carbon content greater than this amount. The plates may be clad with other approved materials.

(g) All appurtenances on the inner container in contact with the lading must be made of approved material compatible with the plate material of the inner container. These appurtenances must not be subject to rapid deterioration by the lading, or must be coated or lined with suitable corrosion resistant material. See AAR Specifications for Tank Cars. Appendix M, M4.05 for approved material specifications for castings for fittings.

§ 79.220-8 Tank heads. (a) Tank heads of the inner container, inner container compartments and outer shell must be of approved contour, and may be flanged and dished or ellipsoidal for pressure on concave side.

(b) Flanged and dished heads must have main inside radius not exceeding 10 feet and inside knuckle radius must be not less than 3¾ inches for steel and alloy steel tanks nor less than 5 inches for aluminum alloy tanks.

(c) Ellipsoidal heads must be an ellipsoid of revolution in which the major axis must equal the diameter of the shell and the minor axis must be one-half the major axis.

§ 79.220-9 Compartment tanks. (a) The inner container may be divided into compartments by inserting interior heads, or by fabricating each compartment as a separate container and joining with a cylinder, or by fabricating each compartment as a separate tank without a joining cylinder. Each compartment must be capable of withstanding, without evidence of yielding or leakage, the required test pressure applied in each compartment separately, or in any combination of compartments.

(b) When the inner container is divided into compartments by fabricating each compartment as a separate container and joining with a cylinder, the cylinder must have a plate thickness not less than that required for the inner container shell and must be applied to the outside surface of the straight flange portion of the container head. The cylinder must fit the straight flange tightly for a distance of at least two times the plate thickness, or 1 inch, whichever is greater and must be joined to the straight flange by a full fillet weld. Distance from fillet weld seam to container head seam must be not less than 1½ inches or three times the plate thickness, whichever is greater.

§ 79.220-10 Welding. (a) All joints must be fusion-welded in compliance with AAR Specifications for Tank Cars, Appendix W. Welding procedures, welders, and fabricators shall be approved.

(b) Radioscopy of the outer shell is not a specification requirement.

(c) Welding is not permitted on or to ductile iron or malleable iron fittings.

§ 79.220-11 Postweld heat treatment. (a) Postweld heat treatment of the inner container is not a specification requirement.

(b) Postweld heat treatment of the cylindrical portions of the outer shell to which the anchorage or draft sills are attached must comply with AAR Specification for Tank Cars, Appendix W.

(c) When cold formed heads are used on the outer shell they must be heat treated before welding to shell if postweld heat treatment is not practicable due to assembly procedures.

§ 79.220-12 Tank mounting. See § 79.10.

§ 79.220-13 Inner container manhole nozzle and cover. (a) Inner container manhole nozzle must be of approved design with access opening at least 18 inches inside diameter, or at least 14 inches by 18 inches obround or oval.

(b) Manhole covers must be of approved type. Design must provide a secure closure of the manhole and must make it impossible to remove the cover while the tank interior is under pressure.

(c) All joints between manhole covers and their seats must be made tight against leakage of vapour and liquid by use of suitable gaskets.

(d) Manhole covers must be cast, forged, or fabricated

metal complying with subsection § 79.220-7(g) of this section.

(e) A seal must be provided between the inner container manhole nozzle and the opening in the outer shell.

§ 79.220-14 Opening in the tanks. Openings in the inner container and the outer shell must be reinforced in compliance with AAR Specifications for Tank Cars, Appendix E. In determining the required reinforcement area for openings in the outer shell, "t" shall be one-fourth inch.

§ 79.220-15 Support system for inner container. The inner container must be supported within the outer shell by a support system of adequate strength and ductility at its operating temperature to support the inner container when filled with liquid lading to any level. The support system must be designed to support, without yielding, impact loads producing accelerations of the following magnitudes and directions when the inner container is loaded so that the car is at its rail load limit, and the car is equipped with a conventional AAR Specification M-901 draft gear.

Longitudinal 7G
Transverse 3G
Vertical 3G

The longitudinal acceleration may be reduced to 3G where a cushioning device of approved design, which has been tested to demonstrate its ability to limit body forces to 400,000 pound maximum at a 10 miles per hour impact, is used between the coupler and the tank structure. The support system must be of approved design and the inner container must be thermally isolated from the outer shell to the best practical extent. The inner container and the outer shell must be permanently bonded to each other electrically either by the support system used, piping, or by a separate electrical connection of approved design.

§ 79.220-16 Expansion capacity. Expansion capacity must be provided in the shell of the inner container as prescribed in § 79.221-1.

§ 79.220-17 Gauging devices, top loading and unloading devices, venting and air inlet devices. (a) When installed, each device must be of approved design which will prevent interchange with any other fixture and must be tightly closed. Each unloading pipe must be securely anchored within the inner container. Each inner container or compartment thereof may be equipped with one separate air connection.

(b) When the characteristics of the commodity for which the car is authorized require these devices to be equipped with valves or fittings to permit the loading and unloading of the contents, these devices including valves, shall be provided with a protective housing except when plug or ball-type valves with operating handles removed are used. Provision must be made for closing pipe connections of valves.

(c) Inner container may be equipped with a vacuum relief valve of approved design. Protective housing is not required.

(d) When a gauging device is required in § 79.221-1, an outage scale visible through the manhole opening must be provided. If loading devices are applied to permit tank loading with cover closed, a telltale pipe may be provided. The telltale pipe must be capable of determining that required outage is provided. The pipe must be equipped with 1/4-inch maximum, NPT control valve mounted outside tank and enclosed within a protective housing. Other approved devices amy be used in place of an outage scale or a telltale pipe.

(e) The bottom of the tank shell may be equipped with a sump or siphon bowl, or both, welded or pressed into the shell. These sumps or siphon bowls, if applied, are not limited in size and must be made of cast, forged, or fabricated metal. Each sump or siphon bowl must be of good welding quality in conjunction with the metal of the tank shell. When the sump or siphon bowl is pressed in the bottom of the tank shell, the wall thickness of the pressed section must not be less than that specified for the shell. The section of a circular cross section tank to which a sump or siphon bowl is attached need not comply with the out-of-roundness requirement specified in Appendix W, W14.06 of the AAR Specifications for Tank Cars. Any portion of a sump or siphon bowl not forming a part of a cylinder of revolution must have walls of such thickness and must be so reinforced that the stresses in the walls caused by a given internal pressure are not greater than the circumferential stress which would exist under the same internal pressure in the wall of a tank of circular cross section designed in accordance with §§ 79.220-6(a) and 79.220-9. In no case shall the wall thickness be less than that specified in § 79.221-1(a).

(f) Protective housing, when required, must be of approved material and must have cover and sidewalls not less than 0;119 inch in thickness.

§ 79.220-18 Bottom outlets. (a) The inner container may be equipped with a bottom outlet of approved design and an opening provided in the outer shell for its access. If applied, the bottom outlet must comply with the following requirements:

(1) On newly built empty cars with truck centres through 60 feet, 6 inches, the extreme projection of the bottom outlet equipment including insulated enclosure must be at least 12 inches above the top of the rail on level track. On cars with truck centres greater than 60 feet, 6 inches, the minimum rail clearance must be in accordance with the graph in Appendix E of the AAR Specifications for Tank Cars. Each bottom outlet reducer and closure and their attachements must be secured to the car by at least a 3/8-inch chain or its equivalent. However: outlet closure plugs may be attached by 1/4-inch chain. When the bottom outlet closure is of the combination cap and valve type, the pipe connection to the valve must be closed by a plug or cap.

(2) Each bottom outlet must be provided with a liquid tight closure at its lower end.

(3) The valve and its operating mechanism must be applied to the outside bottom of the inner container. The valve operating mechanism must be provided with a suitable locking arrangement to insure positive closure during transportation.

(4)Valve outlet nozzle and valve body must be of cast, fabricated or forged metal. If welded to inner container, they must be of good weldable quality in conjunction with metal of tank.

(5) To provide for the attachment of unloading connections, the bottom of the main portion of the outlet nozzle or valve body, or some fixed attachment thereto, must be provided

with threaded cap closure arrangement or bolted flange closure arrangement having minimum 1-inch threaded pipe plug.

(6) If the outlet nozzle and its closure extend below the bottom of the outer shell, a breakage groove or its equivalent must be applied. If a breakage groove is applied, a "V" must be cut (not cast) in the upper part of outlet nozzle at a point immediately below lowest part of valve to a depth that will leave thickness of nozzle wall at the root of the "V" not over one-fourth inch. The outlet nozzle or the valve body may be steam jacketed in which case the breakage groove or its equivalent must be below the steam chamber but above the bottom of the centre sill construction. If the outlet nozzle is not a single piece or if exterior valves are applied, provision must be made for the equivalent of the breakage groove. On cars without continuous centre sills the breakage groove or its equivalent must not be more than 15 inches below the outer shell.

(7) The valve body must be of a thickness which will prevent distortion of the valve seat or valve by any change in contour of the shell resulting form expansion of lading, or other causes, and which will insure that accidental breakage of the outlet nozzle will occur at or below the "V" groove, or its equivalent.

(8) The valve must have no wings or stem projection below the "V" groove or its equivalent. The valve and seat must be readily accessible or removable for repairs, including grinding.

(b) Inner container may be equipped with bottom washout of approved design. If applied, bottom washout must comply with the following requirements:

(1) On newly built empty cars with truck centres through 60 feet, 6 inches, the extreme projection of the bottom washout equipment must be at least 12 inches above the top of rail on level track. On cars with truck centres greater than 60 feet, 6 inches, the minimum rail clearance must be in accordance with the graph in Appendix E of AAR Specifications for Tank Cars.

(2) Bottom washout must be of cast, forged or fabricated metals. If it is welded to the inner container, it must be of good weldable quality in conjunction with metal of tank.

(3) If the washout nozzle extends below the bottom of the outer shell, a "V" groove must be cut (not cast) in the upper part of the nozzle at a point immediately below the lowest part of the inside closure seat or plug to a depth that will leave the wall thickness of nozzle at the root of the "V" not over one-fourth inch. Where the nozzle is not a single piece, provision must be made for the equivalent of the breakage groove. The nozzle must be of a thickness to insure that accidental breakage will occur at or below the "V" groove or its equivalent. On cars without continuous centre sills, the breakage groove or its equivalent must not be more than 15 inches below the outer shell. On cars with continuous centre sills, the breakage groove or its equivalent must be above the bottom of centre sill construction.

(4) The closure plug and seat must be readily accessible or removable for repairs.

(5) The closure of the washout nozzle must be equipped with a 3/4-inch solid screw plug. Plug must be attached by at least a 1/4-inch chain.

(6) Joints between closures and their seats may be gasketed with suitable material.

§ 79.220-19 Safety relief devices. (a) Each inner container or compartment must be equipped with safety relief devices of approved design as prescribed in § 79.221-1.

(b) When used, each safety relief valve must be made of metal not subject to rapid deterioration by the lading, and mounted on the top of the inner container. Total valve discharge capacity must be sufficient to prevent building up of pressure in the inner container to more than 10 psi. above the start-to-discharge pressure. See AAR Specifications for Tank Cars, Appendix A, for formula for calculating discharge capacity. The start-to-discharge pressures and vapour tight pressures must comply with § 79.221-1.

(c) Each inner container or compartment used for the transportation of a corrosive liquid, a flammable solid, an oxidizing material or a poisonous liquid or solid Division 6.1, need not be equipped with a safety relief valve, but if not so equipped, it must have one safety vent at least 1 3/4 inches inside diameter made of material not subject to rapid deterioration by the lading. Each safety vent must be mounted on the top of the inner container. This vent must be of an approved design which will prevent interchange with fixtures prescribed in § 79.220-17. It must be closed with a frangible disc of lead or other approved material. Vent bursting pressure must comply with § 79.221-1. Tanks equipped with vents must be stenciled "NOT FOR FLAMMABLE LIQUIDS".

§ 79.220-20 Reinforcements, when used, and appurtenances not otherwise specified. All attachments to inner container and outer shell must be applied by approved means.

§ 79.220-21 Interior heating system. For heater system inside of inner container see § 79.12.

§ 79.220-22 Closure for openings. (a) All plugs must be solid, with NPT threads, and must be of a length which will screw at least six threads inside the face of fitting or tank. Plugs, when inserted from the outside of the outer shell tank heads, must have the letter "S" at least three-eighths inch in size stamped with steel stamp or cast on the outside surface to indicated the plug is solid.

(b) Openings in the outer shell used during construction for installation must be closed in an approved manner.

§ 79.220-23 Test of tanks. (a) Each inner container or compartment must be tested hydrostatically to the pressure specified in § 79.221-1. The temperature of the pressurizing medium must not exceed 100°F. during the test. The container must hold the prescribed pressure for at least 10 minutes without leakage or evidence of distress. Safety relief devices must not be in place when the test is made.

(b) The inner container must be pressure tested before installation within the outer shell. Items which, because of assembly sequence, must be welded to inner container after its installation within outer shell must have their attachment welds thoroughly inspected by a non-destructive dye penetrant method or its equivalent.

(c) Pressure testing of outer shell is not a specification requirement.

§ 79.220-24 Tests of safety relief valves. Each safety relief valve must be tested by air or gas for compliance with § 79.221-1 before being put into service.

§ 79.220-25 Stamping. To certify that the tank complies with all specification requirements, each outer shell must be plainly and permanently stamped in letters and figures at least ⅜-inch high into the metal near the centre of both outside heads as follows:

	Examples of required stamping
Specifications	CTC-115A60W6.
Inner container:	
Material	ASTM A240-316L
Shell thickness	Shell 0.167 in.
Head thickness	Head 0.150 in.
Tank builder initials	ABC.
Date of original test	00-0000.
Outer shell:	
Material	ASTM A285-C.
Tank builder initials	WYZ.
Car assembler (if other than inner container or outer shell builders)	DEF.

79.220-26 Stencilling. (a) The outer shell, or the jacket if the outer shell is insulated, must be stencilled in compliance with AAR Specifications for Tank Cars, Appendix C.

(b) Stencilling must be applied on both sides of the outer shell or jacket near the centre in letters and figures at least 1 ½ inches high to indicate the safe upper temperature limit, if applicable, for the inner tank, insulation, and the support system.

§ 79.220-27 Certificate of construction. See § 79.5.

§ 79.221 Individual specification requirements applicable to tank car tanks consisting of an inner container supported within an outer shell.

§ 79.221-1 Individual specification requirements. In addition to § 79.220, the individual specification requirements for the inner container are as follows:

Specifications	115A60W1	115A60ALW	115A60W6
Inner container material (see § 79.220-7)	Steel	Al Alloy	Alloy steel
Bursting pressure, p.s.i. (see § 79.220-5)	240	240	240
Minimum plate thickness, shell and heads inches (see § 79.220-6)	⅛	3/16	⅛
Minimum expansion capacity (see § 79.220-16)	2 per cent in tank	2 per cent in tank	2 per cent in tank
Tank pressure, p.s.i. (see § 79.220-23)	60	60	60
Safety relief device (see § 79.220-19)	Valve or vent	Valve or vent	Valve or vent
Valve start-to-discharge pressure, p.s.i. (±3 p.s.i.)	35	35	35
Valve vapour tight pressure (minimum, p.s.i.)	28	28	28
Valve flow rating pressure (maximum p.s.i.)	45	45	45
Vent rupture pressure (maximum, p.s.i.)	45	45	45
Gauging devices (see § 79.220-17)	Required	Required	Required
Top loading and unloading devices (see § 79.220-17)	Optional	Optional	Optional

SUBPART E—SPECIFICATIONS FOR MULTI-UNIT TANK CAR TANKS

§ 79.300 General specifications applicable to multi-unit tank car tanks designed to be removed from car structure for filling and emptying (classes 106A and 110A-W).

§ 79.300-1 Tanks built under these specifications shall meet the requirements of § 79.300, § 79.301 and when applicable § 79.302.

§ 79.300-2 Approval. (a) For procedure for securing approval, see § 79.3.

§ 79.300-3 Type and general requirements. (a) Tanks built under this specification shall be cylindrical, circular in cross section, and shall have heads of approved design. All openings shall be located in the heads.

(b) Each tank shall have a water capacity of at least 1500 pounds and not more than 2600 pounds.

(c) For tanks made in foreign countries other than the United States, a chemical analysis of materials and all tests as specified shall be carried out in Canada under the supervision of a competent and impartial inspector acceptable to the Commission.

§ 79.300-4 Insulation. (a) Tanks shall not be insulated.

§ 79.300-5 Bursting pressure. (a) The minimum required bursting pressure is listed in § 79.301.

§ 79.300-6 Thickness of plates. (a) For class CTC-110A tanks the wall thickness after forming of the cylindrical portion of the tank must not be less than that specified in § 79.301 nor that calculated by the following formula:

$$t = \frac{Pd}{2SE}$$

where:

d = inside diameter in inches;
E = 1.0 welded joint efficiency;
P = minimum required bursting pressure in psi.;
S = minimum tensile strength of plate material in psi. as prescribed in § 79.300-7;
t = minimum thickness of plate material in inches after forming.

(b)For Class CTC-106A tanks, the wall thickness of the cylindrical portion of the tank shall not be less than that specified in § 79.301 and shall be such that at the tank test pressure the maximum fibre stress in the wall of the tank will not exceed 15,750 psi. as calculated by the following formula:

$$s = \frac{p\,(1.3D^2 + 0.4d^2)}{D^2 - d^2}$$

where:

d = inside diameter in inches;
D = outside diameter in inches;
p = tank test pressure in psi.;
s = wall stress in psi.

(c) If plates are clad with material having tensile strength at least equal to the base plate, the cladding may be considered a part of the base plate when determining the thickness. If cladding material does not have tensile strength at least equal to the base plate, the base plate alone shall meet the thickness requirements.

§ 79.300-7 Materials. (a) Carbon steel plate material used to fabricate tanks having heads fusion welded to tank shell must comply with the following specifications with the indi-

cated minimum tensile strength and elongation in the welded condition. The maximum allowable carbon content must be 0.31 per cent when the individual specification allows carbon content greater than this amount. The plates may be clad with other approved materials.

Specifications	Minimum tensile strength (psi) welded condition[1]	Minimum elongation in 2 inches (per cent) welded condition (longitudinal)
ASTM A 285-69 Gr. A	45,000	29
ASTM A 285-69 Gr. B	50,000	20
ASTM A 285-69 Gr. C	55,000	20
ASTM A 515-69 Gr. 65	65,000	20
ASTM A 515-69 Gr. 70	70,000	20

[1]Maximum stresses to be used in calculations.

(b) Carbon steel plate material used to fabricate tanks with forge welded heads must comply with the following specifications:

Specifications	Minimum tensile strength (psi) welded condition[1]	Minimum elongation in 2 inches (per cent) welded condition (longitudinal)
ASTM A 285-69 Gr. A	45,000	29

[1]Maximum stresses to be used in calculations.

(c) All plates must have their heat number and the name or brand of the manufacturer legibly stamped on them at the rolling mill.

§ 79.300-8 Tank heads. (a) Class CTC-110A tanks shall have fusion-welded heads formed concave to pressure. Heads for fusion welding shall be an ellipsoid of revolution 2:1 ratio of major to minor axis. They shall be one piece, hot formed in one heat so as to provide a straight flange at least 1½ inches long. The thickness shall not be less than that calculated by the following formula:

$$t = \frac{Pd}{2SE}$$

where symbols are as defined in § 79.300-6(a).

(b) Class CTC-106A tanks must have forged-welded heads, formed convex to pressure. Heads for forge welding must be torispherical with an inside radius not greater than the inside diameter of the shell. They must be one piece, hot formed in one heat so as to provide a straight flange at least 4 inches long. They must have snug drive fit into the shell for forge welding. The wall thickness after forming must be sufficient to meet the test requirements of § 79.300-16 and to provide for adequate threading of openings.

§ 79.300-9 Welding. (a) Longitudinal joints must be fusion welded. head-to-shell joints must be forge welded on class 106A tanks and fusion welded on class 110A tanks. Welding procedures, welders and fabricators must be approved in accordance with AAR Specifications for Tank Cars, Appendix W.

(b) Fusion-welded joints must be in compliance with the requirements of AAR Specifications for Tank Cars, Appendix W, except that circumferential welds in tanks less than 36 inches inside diameter need not be radiotaped.

(c) Forge-welded joints shall be thoroughly hammered or rolled to insure sound welds. The flanges of the heads shall be forge lap-welded to the shell and then crimped inwardly toward the centre line at least one inch on the radius. Welding and crimping must be accomplished in one heat.

§ 79.300-10 Postweld heat treatment. (a) After welding is complete, steel tanks and all attachments welded thereto, must be postweld heat treated as a unit in compliance with the requirements of AAR Specifications for Tank Cars, Appendix W.

§ 79.300-11 Tank mounting. (a) For tank mounting, see § 79.10.

§ 79.300-12 Protection of fittings. (a) Tanks shall be of such design as will afford maximum protection to any fittings or attachment to the head including the housing referred to in § 79.300-12(b). Tank ends shall slope or curve inward toward the axis so that the diameter at each end is at least 2 inches less than the maximum diameter.

(b) Loading and unloading valves shall be protected by a detachable protective housing of approved design which shall not project beyond the end of the tank and shall be securely fastened to the tank head. Safety relief devices shall not be covered by the housing.

§ 79.300-13 Venting, loading and unloading valves. (a) Valves shall be of approved type, made of metal not subject to rapid deterioration by lading, and shall withstand tank test pressure without leakage. The valves shall be screwed directly into or attached by other approved methods to one tank head. Provision shall be made for closing outlet connections of the valves.

(b) Threads for openings shall be National Gas Taper Threads (NGT) tapped to gauge, clean cut, even and without checks.

§ 79.300-14 Attachments not otherwise specified. (a) Siphon pipes and their couplings on the inside of the tank head and lugs on the outside of the tank head for attaching the valve protective housing must be fusion-welded in place prior to postweld heat treatment. All other fixtures and appurtenances, except as specifically provided for, are prohibited.

§ 79.300-15 Safety relief devices. (a) Unless prohibited in § 79.302, or in Part 73, tanks shall be equipped with one or more safety relief devices of approved type, made of metal not subject to rapid deterioration by the lading and screwed directly into tank heads or attached to tank heads by other approved methods. The total discharge capacity shall be sufficient to prevent building up pressure in tank in excess of 82.5 per cent of the tank test pressure. When safety relief devices of the fusible plug type are used, the required discharge capacity shall be available in each head. See AAR Specifications for Tank Cars, Appendix A, for formula for calculating discharge capacity.

(b) Threads for openings shall be National Gas Taper Threads (NGT) tapped to gauge, clean cut, even and without checks.

(c) Safety relief valves shall be set for start-to-discharge and frangible discs shall burst at a pressure not exceeding that specified in § 79.301.

(d) Fusible plugs shall function at a temperature not exceeding 175°F. and shall be vapour-tight at a temperature of not less than 130°F.

§ 79.300-16 Tests of tanks. (a) After postweld heat treatment, tanks shall be subjected to hydrostatic expansion test in a water jacket, or by other approved methods. No tank shall have been subjected previously to internal pressure within 100 pounds of the test pressure. Each tank shall be tested to the pressure prescribed in § 79.301. Pressure shall be maintained for 30 seconds and sufficiently longer to insure complete expansion of tank. Pressure gauge shall permit reading to accuracy of one per cent. Expansion gauge shall permit reading of total expansion to accuracy of one per cent. Expansion shall be recorded in cubic centimeters.

(1) No leaks shall appear and permanent volumetric expansion shall not exceed 10 per cent of total volumetric expansion at test pressure.

(b) After all fittings have been installed, each tank shall be subjected to interior air pressure test of at least 100 psi. under conditions favourable to detection of any leakage. No leaks shall appear.

(c) Repairs of leaks detected in manufacture or in foregoing tests shall be made by the same process as employed in manufacture of tank. Caulking, soldering, or similar repairing is prohibited.

§ 79.300-17 Tests of safety relief devices. (a) Each valve shall be tested by air or gas before being put into service. The valve shall open and be vapour-tight at the pressures prescribed in § 79.301.

(b) Frangible discs of safety vents must be tested as prescribed in AAR Specifications for Tank Cars, Appendix A, A5.03.

(c) For safety relief devices of the fusible plug type, a sample of the plug used shall function at the temperatures prescribed in § 79.300-15.

(d) The start-to-discharge and vapour-tight pressures shall not be affected by an auxiliary closure or other combination.

§ 79.300-18 Stamping. (a) To certify that the tank complies with all specification requirements, each tank shall be plainly and permanently stamped in letters and figures 3/8 inch high into the metal of valve end chime as follows:

(1) CTC Specification number.

(2) Material and cladding material if any (immediately below the specification number).

(3) Owner's or builder's identifying symbol and serial number (immediately below the material identification). The symbol shall be registered with the Bureau of Explosives through the Commission; duplications are not authorized.

(4) Inspector's official mark (immediately below the owner's or builder's symbol).

(5) Date of original tank test (month and year, such as 1-64 for January 1964). This should be so placed that dates of subsequent tests may easily be added thereto.

(6) Water capacity—0000 pounds.

(b) A copy of the above stamping in letters and figures of the prescribed size stamped on a brass plate secured to one of the tank heads is authorized.

§ 79.300-19 Inspection. (a) Tank shall be inspected by a competent and impartial inspector who is acceptable, for inspection in Canada to the Commission for inspections in the United States to the Bureau of Explosives. For tanks made outside of Canada or the United States, the specified inspection shall be made in Canada.

(b) The inspector shall carefully inspect all plates from which tanks are to be made and secure records certifying that plates comply with the specification. Plates which do not comply with § 79.300-7 shall be rejected.

(c) The inspector shall make such inspection as may be necessary to see that all the requirements of this specification, including markings, are fully complied with; shall see that the finished tanks are properly stress relieved and tested.

(d) The inspector shall stamp his official mark on each accepted tank as required in § 79.300-18, and render the report required in § 79.300-20.

§ 79.300-20 Reports. (a) Before a tank is placed in service, the inspector shall furnish to the builder, tank owner, the Commission, Bureau of Explosives and the Secretary, Mechanical Division, Association of American Railroads, a report in approved form certifying that the tank and its equipment comply with all requirements of this specification.

(b) For builder's Certificate of Construction, see § 79.5(b), (c), and (d).

§ 79.301 Individual specification requirement for multi-unit tank car tanks. (a) In addition to § 79.300 the individual specification requirements are as follows:

CTC Specifications	106A-500-X	106A-800-X	110A-500-X	110A-800-W	110A-1000-W
Bursting pressure, psi. (see § 79.300-5)	None specified	None specified	1250	2000	2500
Minimum thickness shell, inches	13/32	11/16	11/32	15/32	19/32
Test pressure, psi, (see § 79.300-16)	500	800	500	800	1000
Safety relief devices, psi. (see § 79.300-15)					
Start-to-discharge, or burst maximum psi.	375	600	375	600	750
Vapour-tight, minimum psi	300	480	300	480	650

§ 79.302 Special commodity requirements for multi-unit tank car tanks. (a) In addition to §§ 79.300 and 79.301, the following requirements are applicable:

Commodity	Safety relief device	Valve protective housing	Miscellaneous
Chlorine trifluoride	Prohibited[1]		
Chloropicrin	Prohibited[1]	Gas tight[2]	
Hydrofluoric acid	Prohibited[1]	Gas tight[2]	
Hydrogen Sulphide	Prohibited[1]		5
Methyl mercaptan	Prohibited[1]		
Nitrogen dioxide liquid	Prohibited[1]	Gas tight[2]	
Nitrogen peroxide liquid	Prohibited[1]	Gas tight[2]	
Nitrogen tetroxide liquid	Prohibited[1]	Gas tight[2]	
Nitrogen tetroxide-nitric oxide mixtures	Prohibited[1]	Gas tight[2]	
Nitrosyl chloride	Fusible plugs required		4
Phosgene	Prohibited[1]	Gas tight[2]	
Titanium tetrachloride (anhydrous)	Prohibited[1]		
Vinyl chloride			3
Vinyl methyl ether			5

[1]When safety relief devices are prohibited, containers may be equipped with solid steel plugs in the safety device openings.

[2]The detachable protective housing for the loading and unloading valves must withstand tank test pressure without leakage and must be approved by the Commission or the Bureau of Explosives.

[3]All parts of valves and safety relief devices in contact with the lading must be of a metal or other material suitably treated if necessary which will not cause formation of any acetylides.

[4]Tanks for nitrosyl chloride must be nickel-clad.

[5]Valve outlets must have gas tight plugs or caps applied.

SUBPART F—SPECIFICATIONS FOR LIQUEFIED HYDROGEN TANK CAR TANKS AND SEAMLESS STEEL TANKS.

§ 79.400 General specifications applicable to liquefied hydrogen tank car tanks.

§ 79.400-1 General. (a) Tanks built under these specifications must meet the requirements of §§ 79.400 and 79.401.

§ 79.400-2 Approval. (a) For procedure for securing approval, see § 79.3.

§ 79.400-3 Type. (a) A tank built in accordance with this specification shall consist of an inner (pressure) container suitably supported within an outer shell, and forming a part of a railway car. The car shall be equipped with piping systems for vapour venting, transfer to the lading and with safety relief devices, controls, gauges and valves prescribed herein for safe operation of the unit in storage, transport and transfer of the lading.

(b) The inner (pressure) container shall be a fusion-welded cylindrical shell closed at each end with formed heads convex outward and suitable for operation at temperatures as low as −432°F.

(c) The outershell shall be a fusion-welded cylindrical shell with formed heads.

(d) Compartments. When the interior of the tank is divided into compartments, each compartment must have two heads designed convex outward and comply with all other requirements described in this specification.

§ 79.400-4 Bursting pressure. (a) The minimum required bursting pressure of the inner container is listed in § 79.401.

§ 79.400-5 Thickness of plates. (a) The wall thickness of the inner container shell and heads shall not be less than that specified in § 79.401, nor that calculated by the following formula:

$$t = \frac{Pd}{2SE}$$

where:

d = inside diameter in inches;
E = efficiency of longitudinal welded joint=90 per cent;
P = minimum required bursting pressure in psi.;
S = minimum ultimate tensile strength of plate material in psi. as prescribed in § 79.400-6;
t = minimum design thickness of plate in inches.

§ 79.400-6 Materials. (a) The material used in the shell, heads and appurtenances shall be suitable for use at minus 423°F. and compatible with the lading and the usual cleaning compounds recommended for this service. Chromium-nickel steel plate made to ASTM specification A-240-61T, Type 304, is an approved material and, when used, it shall be in the annealed condition prior to fabricating, forming or fusion-welding. Other approved materials may be used. The minimum ultimate tensile strength shall be as given as ASTM specification A-240, Type 304.

§ 79.400-7 Heads. (a) The formed heads on the inner container shall preferably be ellipsoids of revolution in which the major axis shall equal the inside diameter of the shell and the minor axis shall be one-half of the major axis. The minimum thickness after forming shall be determined by the provisions of § 79.400-5(a) except that an efficiency of 100 per cent may be used for a seamless head. Formed heads of other approved contours and thicknesses may be used but in no case shall the plate thickness be less than 3/16 inch.

§ 79.400-8 Welding—inner container. (a) All joints must be fusion-welded in compliance with the requirements of the AAR Specifications for Tank Cars, Appendix W, except that the following requirements supersede requirements listed under "Test Plates," "Bend Test," and ("Impact Test" of Appendix W.)

(b) Test plates. A welded test plate of the dimensions shown in Figure W-2 of AAR Specifications for Tank Cars, Appendix W shall be made for each container using the same weld procedure as used in welding the longitudinal seams of the container. Test plates shall be prepared from material having the same material specification and mill heat numbers as used in the shell or main heads of the inner container. After welding is completed, the test plate shall be radiographed, and the standards of judgement of weld acceptability as set forth in Par. 10.74-1 of AAR Specifications for Tank Cars, Appendix W, shall be followed.

(c) Test specimens. The following test specimens shall be removed from the welded test plate and subjected to tests prescribed below:

(1) Bend test. Four transverse bend test specimens shall be removed from the welded test plate transverse to the welded joint of the test plate. The specimens shall be of rectangular cross section 1½ inches wide and the full thickness of the test plate. Weld reinforcements on each side of each test specimen shall be removed flush with the plane of the plate surface. Specimens shall be saw-cut from the test plate. Removal of test specimens from the test plate by means of flame cutting is prohibited. The specimens shall be subjected to a guided bend test, and two transverse face bend tests and two transverse root bend tests shall be performed. A bend test specimen that reveals no cracks or other open defects exceeding 1/8 inch measured in any direction on the convex surface of the specimen shall be considered to have passed the bend test. Cracks occurring on the corners of the specimen during the test shall not be considered as cause for rejection, unless there is definite evidence that they are the result of slag inclusions in the weld or other internal defects.

(2) Impact tests. Three sets of three impact test specimens shall be saw-cut from the welded test plate. These specimens shall be used for determining the impact properties of the plate material, weld zone and heat-affected zone. Impact test specimens shall be of the Charpy type, keyhole or milled U-notch, with the base of the notch normal to the plate surface, and shall conform in all respects to Figure 3 of ASTM Specification E-23-60-T. Impact test specimens shall be cooled in liquid nitrogen (−320°F.). The apparatus for testing the spec-

imens shall be in accordance with the requirements of ASTM Specification E-23-60-T. The test piece and handling tongs shall be cooled for a length of time sufficient to reach the temperature of liquid nitrogen. The specimen shall be quickly transferred from the cooling device to the anvil of the testing machine and broken within a time lapse of not more than six seconds.

(3) Impact properties. The impact properties of each set of impact specimens shall be not less than the values listed below:

Size of specimen	Minimum impact value required for average of each set of 3 specimens	Minimum impact value permitted on 1 specimen only of each set of 3 specimens
55 mm × 10 mm × 10 mm . .	15 ft.-lb.	10 ft.-lb.
55 mm × 10 mm × 7.5 mm .	12.5 ft.-lb.	8.5 ft.-lb.
55 mm × 10 mm × 5 mm . . .	10 ft.-lb.	7 ft.-lb.
55 mm × 10 mm × 2.5 mm .	5 ft.-lb.	3.5 ft.-lb.

When the average value of the three specimens equals or exceeds the minimum value permitted for a single specimen, and the value for more than one specimen is less than the minimum value required for the average of the three specimens, or when the impact value of one specimen is below the minimum value permitted for a single specimen, a retest of three additional specimens shall be made. The value from each retest specimen shall be equal or exceed the minimum value required for the average of three specimens given above. When an erratic result is caused by a defective specimen or there is uncertainty in the test procedure, a retest is authorized.

§ 79.400-9 Stress relieving. (a) Stress relieving of the inner container is not a requirement of this specification.

§ 79.400-10 Cleaning interior containers. (a) The interior of the tank and all lines connecting to it shall be thoroughly cleaned. Proper precautions shall be taken to avoid subsequent recontamination of the system after cleaning.

§ 79.400-11 Test of inner container. (a) After all items to be welded to the inner container have been welded in place, the inner container shall be pressurized hydrostatically or pneumatically to the test pressure prescribed in § 79.401. This temperature of the pressurizing medium shall not exceed 100°F. during the test. The container shall hold the prescribed pressure for a period of not less than ten minutes without leakage or evidence of distress. Due regard should be taken of the potential hazard involved in a pneumatic test. After the container has passed the pressure test, the container and piping shall be emptied of all water and purged of all water vapour if water is used for testing.

(b) Caulking of welded joints to stop leaks developed during the foregoing test is prohibited. Repairs to welded joints shall be made as prescribed in § 79.400-8.

§ 79.400-12 Radiography. (a) All longitudinal and circumferential double-butt, fusion-welded joints of the inner container and outer shell shall be examined throughout their entire length by the X-ray or gamma-ray method of radiography. The standards of judgment for acceptability of welds examined by radiography shall be in accordance with Par. 10.74-1 of AAR Specifications for Tank Cars, Appendix W.

§ 79.400-13 Support system for inner container. (a) The inner container shall be supported within the outer shell by a support system of adequate strength and ductility at its operating temperature to support the inner container when filled with liquid lading to any level incidental to operation of the complete unit as a railway tank car. The support system shall by designed to be capable of supporting, without yielding, impact loads producing accelerations of the following magnitudes and directions when the inner container is fully loaded, and the car is equipped with a conventional AAR Specification M-901 draft gear:

Longitudinal 7G
Transverse 3G
Vertical 3G

The longitudinal acceleration may be reduced to 3G where a cushioning device of approved design, which has been tested to demonstrate its ability to limit body forces to 400,000 pounds maximum at 10 miles per hour, is used between the coupler and the tank structure. The support system shall be of an approved design and such that the inner container shall be thermally isolated from the outer shell to the best practical extent.

§ 79.400-14 Access to inner container. (a) The inner container shall be provided with a means of access having a minimum inside diameter of 16 inches and having a welded closure so designed as to allow it to be reopened by grinding or chipping and to be closed again by rewelding without a need for new parts. A cutting torch shall not be used. The closure and the reinforcement of the opening in the container shall be of approved design and made of the same material as is used in the container. Consideration must be given in the design to minimizing contamination of the container and the vacuum space when the closure is opened and closed. The outer shell shall be provided with an access opening of sufficient size (and aligned with the container access opening) to permit removal of the container closure and access into the container. The closure and the reinforcement of the opening in the outer shell shall be of approved design and made of the same material as is used in the outer shell. The closure shall preferably be so designed as to allow it to be reopened by grinding or chipping and to be closed again by rewelding without a need for new parts. A passageway connecting the inner container with the outer shell is not a specification requirement.

§ 79.400-15 Outer shell. (a) Design. The outer shell shall be designed to withstand an external pressure of one atmosphere.

(b) Thickness of plates. The wall thickness of steel plates in the cylindrical portion of the outer shell shall be not less than 7/16 inch.

(c) Material. All plate material in the outer shell shall be flange quality or fibrebox quality steel, made to an approved specification, the carbon content of which shall not exceed 0.31 per cent. Steel plate materials in accordance with material specifications listed in Group 1, Table A of AAR Specifications for Tank Cars, Appendix W, are approved for used in the outer shell of tanks built to this specification.

(1) All steel castings, steel forgings and steel structural shapes shall be of material to an approved specification.

(2) Rivets, when used, shall be of steel to an approved specification.

(d) Heads. The formed heads at each end of the outer shell preferably shall be an ellipsoid of revolution in which the major axis shall equal the inside diameter of the shell and the minor axis shall be one-half of the major axis. Formed heads of other approved contours may be used, but in not case shall the wall thickness be less than 7/16 inch.

(e) Stiffening rings. If stiffening rings are used in designing the cylindrical portion of the outer shell for external pressure, they shall be attached to the shell by means of fillet welds on each side of the ring. Outside stiffening ring attachment welds shall be continuous. Inside ring attachment welds may be intermittent. When intermittent welds are used, the total length of welds on each side of the ring shall not be less than one-third of the circumference of the outer shell. Where a closed section is used it shall be continuously welded on the outside of each leg. A portion of the outer shell may be included when calculating the moment of inertia of the ring. The effective width of shell plate, W, on each side of the attachment of the stiffening ring is given by:

$$W = 0.78 \sqrt{Rt}$$

where:

W = width of shell effective on each side of the stiffener—inches;
R = outside radius of the outer shell—inches;
t = plate thickness of the outer shell—inches.

Where a stiffener is used which consists of a closed section having two webs attached to the outer shell, the shell plate between the webs shall be included up to the limit of twice the value of W defined above. The outer "flange" of the section shall be subject to the same limitation with W bases on the R and the t of the flange. Where two separate members, such as two angles, are located less than 2W apart they may be treated as a single stiffening member. (The maximum length of shell plate which may be considered effective is 4W.)

(1) The stiffener rings shall have a moment of inertia large enough to support an external pressure of 37.5 psig. as determined by either of the following formula:

$$I = \frac{0.035 D^2 L Pc}{E}$$

$$I = \frac{0.046 D^2 L Pc}{E}$$

where:

I = required moment of inertia of stiffener about centroidal axis parallel to vessel axis—inches^4;
I^1 = required moment of inertia of combined section of stiffener and effective width of shell plate, about centroidal axis parallel to vessel axis—inches^4;
D = outside diameter of outer shell—inches;
L = one-half of the distance from the centerline of the stiffening ring to the next line of support on one side, plus one-half of the centreline distance to the next line of support if any, on the other side of the stiffening ring, both measured parallel to the axis of the vessel—inches. (A line of support is: (1) a stiffening ring which meets the requirements of this paragraph, or (2) a circumferential line on a head at one-third the depth of the head from the head tangent line.);
Pc = critical collapsing pressure (37.5 psig. minimum);
E = modulus of elasticity of stiffener material—psi.

(2) The cylindrical portion of the outer shell between stiffening rings shall be stiff enough to withstand an external pressure of 37.5 psig. (critical collapsing pressure) as determined by the following formula:

$$Pc = \frac{2.6E (t D)^{2}}{L/D - 0.45 (t/D)^{0.5}}$$

where:

Pc = critical collapsing pressure (37.5 psig. minimum);
E = modulus of elasticity of shell material—lb./sq. inch;
t = minimum thickness of shell material—inches;
D = outside diameter of shell—inches;
L = distance between stiffening ring centres—inches. (The heads may be considered as stiffening rings located one-third of the head depth from the head tangent line.)

(3) The permissible out-of-roundness of the cylindrical portion of the outer shell shall be no greater than that permitted in Section VIII for out-of-roundness for external pressure of the ASME Boiler and Pressure Vessel Code.

(4) Where loads are applied to the outer shell or to the stiffening rings from the support system used to support the inner container within the outer shell, additional stiffener rings or an increased moment of inertia of stiffening rings designed for the external pressure will have to be provided to carry the support loads.

(f) Welding. all joints shall be fusion welded in compliance with the requirements of AAR Specifications for Tank Cars, Appendix W. Welding procedures, welders and fabricators shall be approved. No more than two circumferential closing joints in the cylindrical portion of the outer shell, including head to shell joints, shall be single-welded butt joints using a backing strip on the inside of the joint. If the interior of the outer shell is divided into compartments, the compartment heads shall be attached inside the shell by fillet welding.

(g) Stress relieving. The cylindrical portion of the outer shell with the exception of the circumferential closing seams shall be stress relieved in accordance with the requirements of Par. W-15.01 of the AAR Specifications for Tank Cars, Appendix W. All items welded to the shell shall be attached before stress relieving. Welds securing the inner container support system to the outer shell which cannot feasibly be made before final assembly and the tank heads at each end of the shell need not be stress relieved.

(h) Tests of outer shell. Pressure testing of outer shell is not a specification requirement.

§ 79.400-16 Insulation. (a) The annular space between the two shells shall contain an approved insulating system so installed as to insure against excessive settling and the creation of voids in the insulation when the car is in service. The material shall not burn or spark when touched with a glowing platinum wire in an atmosphere of air or lading. The insulation shall be such that the total heat transfer from the atmosphere at ambient temperature to the hydrogen at atmospheric pressure will not vaporize more than 5.2 pounds of liquefied hydrogen per hour (1000 scfh at 60°F.) when the car is sta-

tionary.

(b) Annular space. The distance between the outside wall of the inner container and the inside wall of the outside shell shall be not less than two inches.

§ 79.400-17 Piping, vacuum line, vapour phase line, loading and unloading lines. (a) Vacuum lines. The outer shell shall be provided with fittings to permit effective evacuation of the annular space between the outer shell and inner container.

(b) Product lines. The piping systems for vapour and liquid phase transfer and venting shall be made from materials compatible with the product and having satisfactory properties at minus 123°F. All valves, gauges, and closures shall be mounted within suitable protective housings. The outlets of all vapour phase and liquid phase lines shall be so located that accidental discharge from these lines will not impinge on any metal of the outer shell, car structure, trucks or safety appliances.

(c) Vapour phase line. Vapour phase line of sufficient size to permit safety devices covered in § 79.400-18 (c)(1) and (2) connected to this line to operate at their designed capacity without excessive pressure buildup in the tank shall connect to the inner container. The vapour phase line shall have a manually operated shut-off valve located as close as possible to the outer shell and shall have a closure that is liquid and gas tight.

(d) Vapour phase blow-down line. A blow-down line shall be provided and it may be attached to the vapour phase line specified in § 79. 400-17(c) and ahead of the shut-off valve in that line. It shall have a manually operated shut-off valve located as close as possible to the outer shell. The outlet from this line shall be outside its housing and positioned so that the discharge will be directed upward and away from operating personnel.

(e) Pressure building system. Not a specification requirement. If a pressure building system is provided for the purpose of pressurizing the vapour space of the inner container to facilitate unloading the liquid lading, the system shall be of approved design.

(f) Loading and unloading line. A liquid phase transfer line shall be provided and shall have a manually operated, vacuum jacketed, shut-off valve located as close as possible to the outer shell. The section of line between the outer shell and the valve shall be vacuum jacketed. A vapour trap shall be incorporated in the line and shall be located as close as possible to the inner shell.

§ 79.400-18 Safety relief devices. (a) The tank shall be provided with safety relief devices for the protection of the tank assembly and piping systems. The discharge from these devices shall be directed away from operating personnel, principal load bearing members of the outer shell, car structure, trucks and safety appliances. Vent or weep holes in safety devices are prohibited. All main safety relief devices shall discharge to the outside of protective housings in which they are mounted. This provision does not apply to small safety relief valves installed to protect isolated short sections of lines between the final valve and end closure.

(b) Materials. Materials used in safety relief devices shall be suitable for use at minus 423°F and otherwise compatible with hydrogen in the liquid or vapour phase.

(c) Inner container. Safety relief devices for the inner container shall be attached to piping connected to the vapour phase of the inner container and mounted so as to remain in ambient temperature prior to operation. Additional requirements are as follows:

(1) Safety vent. The inner container shall be equipped with a safety vent without an intervening shut-off valve and designed to function at a pressure less than the test pressure of the inner container. The safety vent capacity shall be sufficient to limit the pressure within the inner container to not over the test pressure during all conditions of operation, both normal and abnormal including fire with loss of vacuum, when the insulation space is filled with gaseous hydrogen at atmospheric pressure. The discharge shall be directed upward.

(2) Safety relief valve. The inner container shall be equipped with a safety relief valve without an intervening shut-off valve and set to start to discharge at a pressure not greater than 75 per cent of the test pressure prescribed in § 79.401, less 15 psi. Safety relief valve capacity shall be sufficient to limit the pressure within the inner container to 85 per cent of the test pressure, less 15 psi., even when the insulation space is filled with gaseous hydrogen at atmospheric pressure (no vacuum) and the outer shell is at 130°F. The minimum size relief valve body shall be ¾ inch IPS. The discharge shall be directed upward. See AAR Specifications for Tank Cars, Appendix A, for formula for calculating discharge capacity.

(3) Pressure control device. The inner container shall be equipped with an approved device to prevent the discharge of a mixture exceeding 50 per cent of the lower flammable limit to the atmosphere under normal conditions of storage and transport of lading. This device shall be set to start to discharge at a pressure not greater than 17 psig. and shall have sufficient capacity to limit the pressure within the inner container to 17 psig. when the discharge is equal to twice the normal venting rate during transportation with normal vacuum and the outer shell at 130°F.

(4) Safety interlock. Not a specification requirement. If a safety interlock is provided for the purpose of allowing transfer of the lading at a pressure higher than the pressure control device setting but less than the safety relief valve setting, the design shall be as follows:

(i) The safety interlock shall not affect the discharge path of the safety relief valve or safety vent at any time. The safety interlock shall automatically provide an unrestricted discharge path for the pressure control device at all times except when the inner container is being pressurized through the vapour vent line shut-off valve for the transfer of lading. The safety interlock shall automatically prevent operation of the pressure control device only when the inner container is being pressurized through the vapour vent line shut-off valve for transfer of lading. Automatic operation shall be assured by a mechanical interlock of approved design between the vapour vent line shut-off valve and a pressure control device shut-off valve.

(d) Outer shell. The outer shell shall be provided with a suitable relief device to prevent build up of internal pressure in excess of 16 psig. The discharge capacity of the relieving device shall be sufficient to vent pressure accumulating within the annular space. Safety vent if used, shall be designed to prevent distortion of the frangible disc when

the annular space is evacuated.

(e) Piping system. Additional safety relief valves shall be installed in each piping circuit where the system can be isolated by closing the shut-off valves so that no dangerous pressure can be built up. These safety relief valves shall be designed to open at a pressure sufficiently low to prevent damage to the component or system affected.

§ 79.400-19 Tests of safety relief valves. (a) Each valve shall be tested by air or gas for compliance with § 79.401 before being put into service.

§ 79.400-20 Control valves and gauges. (a) Control valves.

(1) Manually-operated shut-off valves and control valves shall be provided wherever needed for control of the vapour phase pressure, vapour phase venting, liquid transfer and liquid flow rates.

(2) Control valves and shut-off valves shall be designed and constructed to provide positive shut-off, and to provide minimum resistance to flow when open. These valves shall be so constructed that the packing glands and control handles are separated from the valve bodies by a sufficient length of low conductivity material to reduce to minimum the collection of frost on the control handles when low temperature gas or liquid is passing through or in contact with the valve parts.

(3) Control valves and shut-off valves shall be of approved design and fabricated from materials not adversely affected by extended periods of contact with the lading in the liquid or vapour phase, or moist air and water.

(4) Packing, if used in these valves, shall be satisfactory for use in contact with the lading in the liquid or vapour phase and shall be of approved materials which will effectively seal the valve stem without causing difficulty of operation.

(5) Control valves and shut-off valves shall be so installed that they can be readily operated and their control handles will be readily accessible to the operator. These valves shall be so mounted that operation of the valves will not transmit excessive forces to the piping system.

(b) Instruments necessary to the effective and safe operation of the tank when transporting, transferring or storing the liquid commodities for which the car is designed shall be provided. Instruments, except portable instruments, shall be securely mounted on panels within suitable protective housings and shall include the following:

(1) Liquid level gauge. Connections shall be provided for a liquid level gauge of approved design to indicate the quantity of liquefied hydrogen within the inner container. The gauge, if not portable, shall be mounted in a position where it will be readily visible to an operator during transfer operations or storage. The connection for a portable gauge must be readily accessible.

(2) Fixed dip tube. A fixed length dip tube shall be provided with a manually operated shut-off valve located as close as possible to the outer shell and with in a suitable housing. It shall be so installed as to indicate the maximum liquid level for the allowable filling density at 1 psig.

(3) Vapour phase pressure gauge. A vapour phase pressure gauge of approved design shall be provided to indicate the vapour pressure within the inner container. The gauges shall be mounted so as to be readily visible to an operator.

(4) Vacuum gauge. Connections shall be provided for a vacuum gauge of approved design to indicate the absolute pressure in the annular space between the outer shell and the inner container. The gauge, if not portable, must be mounted in a position where it will be readily visible to an operator. The connection for a portable gauge must be readily accessible.

§ 79.400-21 Protective housings. (a) The protective housings specified for all valves, gauges and closures shall be designed to protect the enclosed components from direct solar radiation, mud, sand, adverse environmental exposure, and mechanical damage. The housings shall be so designed as to provide reasonable access to the enclosed components for operation, inspection, and maintenance, and so that vapour concentration cannot build up to a dangerous level inside the housings in the event of valve leakage or pop safety valve operation. The closure shall be operable by personnel wearing heavy gloves and shall incorporate provisions for locks or seals.

§ 79.400-22 Operating Instructions. (a) Identification. All valves and gauges shall be clearly identified with corrosion-resistant name plates. A plate of corrosion-resistant material bearing directions and precautionary instructions for the safe operation of this equipment during storage and transfer operations shall be securely mounted so as to be readily visible to an operator. This instruction plate shall be mounted in each housing containing operating equipment and controls for product handling. The instructions shall be clear, concise and adequate in the description of the operations to be performed by the operator during storage or transfer operations. These instructions shall include a diagram of the tank and its piping system, with the various gauges, control valves, and safety relief devices clearly identified and located. The operating instructions for the vacuum system may be on a separate plate which is installed only in the housing containing vacuum controls and gauges.

§ 79.400-23 Stamping. (a) Each tank shall be marked certifying that the tank complies with all requirements of this specification. These marks shall be as follows:

(1) CTC.....(insert applicable number per § 79.401) in letters and figures at least 3/8 inch high stamped plainly and permanently into the metal near the centre of the main head of the outer shell at the "B" end of the car by the tank builder or the party assembling the complete tank unit. This mark must also be stencilled on the outer shell in letters and figures at least 1½ inches high by the party assembling the complete car.

(2) Initials of the builder of the inner container, together with information as to the material used for the shell and heads of the inner container, shell thickness, head thickness and inside diameter of the inner container, shall be stamped in letters and figures at least 3/8 inch high into the metal immediately below the marks specified in § 79.400-23 (a)(1).

(3) Initials of builder of the outer shell in letters and figures at least 3/8 inch high stamped plainly and permanently into the metal immediately below the marks specified in § 79.400-23(a)(2).

(4) Date of original test of inner container and initials of party conducting the test in letters and figures at least 3/8 inch high plainly and permanently stamped immediately below the

marks specified in § 79.400-23(a)(3). Any marking, stencilling or stamping on the shell or heads of the inner container is prohibited. These markings must also be stencilled on the outer shell in letters and figures at least 1½ inches high.

(5) Initials of company assembling the complete car in letters and figures at least ⅜ inch high plainly and permanently stamped immediately below the marks specified in § 79.400-23(a)(4). These marks shall also be stencilled on the outer shell in letters and figures ata least 1½ inches high.

(6) In lieu of stamping required in § 79.400-23(a)(1), (a)(2), (a)(3), (a)(4), and (a)(5), the markings specified by these paragraphs may be incorporated on a data plate of corrosion-resistant metal fillet welded in place on the main head of the outer shell of the "B" end of the car.

§ 79.400-24 Stencilling. (a) The outer shell of the tank shall be stencilled in compliance with the requirements of AAR Specifications for Tank Cars, Appendix C.

(1) Date on which the principal safety relief valves were tested, pressure at which tested, place where tested and initials of party making test shall be stencilled on the outer shell in letters and figures at least 1 inch high.

(2) The date on which the frangible disc was replaced and the initials of the party making the replacement shall be stencilled on the outer shell in letters and figures 1 inch high. The identification of the manufacturer, the type of frangible disc installed, and the rated rupture pressure is normally shown on the tab of the disc. If it is not given thereon, this information shall also be stencilled on the outer shell in letters and figures 1 inch high.

(3) Tank cars of approved design built to this specification are authorized for the transportation of "LIQUEFIED HYDROGEN ONLY" and shall be stencilled in letters at least 2 inches high on the outer shell immediately above the marks specified in paragraph 79.400-23(a)(1).

§ 79.400-25 Reports. (a) Certificate of Construction, see § 79.5.

§ 79.401 Individual specification requirements for liquefied hydrogen tank car tanks. (a) In addition to § 79.400 the individual specification requirements are as follows:

CTC Specification	113A60-W	113A175-W
Material (see § 79.400-6)	Stainless steel	Stainless steel
Bursting pressure, psi. (see § 79.400-4)	240	440
Minimum thickness, inches, shell and head	3/16	5/16
Test pressure, psi. (see § 79.400-11)	60	175
Safety relief devices		
Safety vent, maximum bursting pressure, psi	60	175
Tolerance, psi	+0, −10	+0, −22
Safety relief valve		
Start-to-discharge	30	115
Start-to-discharge tolerance	±2.0	±4.0
Vapour-tight, maximum	24	95
Pressure control device		
Start-to-vent, psi. maximum	17	17
Outer shell safety vent, psi. maximum	16	16

Specification CTC-107A****

SEAMLESS STEEL TANKS

§ 79.500 Seamless steel tanks to be mounted on or forming part of a car.

§ 79.500-1 Tanks built under these specifications shall meet the requirements of § 79.500.

§ 79.500-2 Approval. (a) For procedure for securing approval, see § 79.3.

§ 79.500-3 Type and general requirements. (a) Tanks built under this specification shall be hollow forged or drawn in one piece. Forged tanks must be machined inside and outside before ends are necked-down and, after necking-down, the ends must be machined to size on the ends and outside diameter. Machining not necessary on inside or outside of seamless steel tubing, but required on ends after necking-down.

(b) For tanks made in foreign countries other than the United States chemical analysis of material and all tests as specified must be carried out within the limits of Canada under supervision of a competent and disinterested inspector; in addition to which, provisions in § 79.500-18(b) and § 79.500-18(c) must be carried out at the point of manufacture by a recognized inspection bureau with principal office in the United States or Canada.

(c) the terms "marked end" and "marked test pressure" used throughout this specification are defined as follows:

(1) "Marked end" is that end of the tank on which marks prescribed in § 79.500-17 are stamped.

(2) "Marked test pressure" is that pressure in pounds per square inch which is indicated by the figures substituted for the **** in the marking CTC-107A**** stamped on the marked end of tank.

(d) The gas pressure at 130°F. in the tank shall not exceed 7/10 of the marked test pressure of the tank.

§ 79.500-4 Thickness of wall. (a) Minimum thickness of wall of each finished tank shall be such that at a pressure equal to 7/10 of the marked test pressure of the tank, the calculated fibre stress in pounds per square inch at inner wall of tank multiplied by 3.0 will not exceed the tensile strength of any specimen taken from the tank and tested as prescribed in § 79.500-7(b). Minimum wall thickness shall be ¼ inch.

(b) Calculations to determine the maximum marked test pressure permitted to be marked on the tank shall be made by the formula:

$$P = \frac{10S\ D^2 - d^2}{7(D^2 + d^2)}$$

where:

P = Maximum marked test pressure permitted;

$$S = \frac{U}{3.0}$$

where: U = Tensile strength of that specimen which shows the lower tensile strength of the two specimens taken from the tank and tested as prescribed in § 79.500-7 (b).

3 = Factor of safety.

$\frac{D^2 - d^2}{D^2 + d^2}$ = The smaller value obtained for this factor by the operations specified in § 79.500-4 (c).

(c)Measure at one end, in a plane perpendicular to the longitudinal axis of the tank and at least 18 inches from that end before necking-down:

d = Maximum inside diameter (inches) for the location under consideration; to be determined by direct measurement to an accuracy of 0.05 inch.

t = Minimum thickness of wall for the location under consideration; to be determined by direct measurement to an accuracy of 0.001 inch.

Take $D = d + 2t$.

Calculate the value of $\frac{D^2 - d^2}{D^2 + d^2}$

(1) Make similar measurements and calculation for a corresponding location at the other end of the tank.

(2) Use the smaller result obtained, from the foregoing, in making calculations prescribed in paragraph (b) of this section.

§ 79.500-5 Material. (a) Tanks shall be made from open-hearth or electric steel of uniform quality. Material must be free from seams, cracks, laminations, or other defects injurious to finished tank. If not free from such defects, the surface may be machined or ground to eliminate these defects. Forgings and seamless tubing for bodies or tanks must be stamped with heat numbers.

(b) Steel (see Note 1) must conform to the following requirements as to chemical composition.

Designation	Class I (per cent)	Class II (per cent)	Class III (per cent)
Carbon, maximum	0.50	0.50	0.53
Manganese, maximum	1.65	1.65	1.85
Phosphorus, maximum	.05	.05	.05
Sulphur, maximum	.05	.05	.05
Silicon, maximum	.35	.30	.37
Molybdenum, maximum	.....	.25	.30
Chromium, maximum	.....	.30	.30
Sum of manganese and carbon not over	2.10	2.10	.....

NOTE 1: Alternate steel containing other alloying elements may be used if approved.

(1) For instructions as to the obtaining and checking of chemical analysis, see § 79.500-18(b)(3).

§ 79.500-6 Heat treatment. (a) Each necked-down tank shall be uniformly heat treated. Heat treatment shall consist of annealing or normalizing and tempering for Class I, Class II and Class III steel or oil quenching and tempering for Class III steel. Tempering temperatures shall not be less than 1000°F. Heat treatment of alternate steels must be approved. All scale must be removed from outside of tank to an extent sufficient to allow proper inspection.

(b) To check uniformity of heat treatment, Brinnel hardness tests shall be made at 18 inch intervals on the entire longitudinal axis. The hardness must not vary more than 35 points in the length of the tank. No hardness tests need be taken within 12 inches from point of head to shell tangency.

(c) A magnetic particle inspection shall be performed after heat treatment on all tanks subjected to a quench and temper treatment to detect the presence of quenching cracks. Cracks shall be removed to sound metal by grinding and the surface exposed shall be blended smoothly into the surrounding area. A wall thickness check shall then be made of the affected area by ultrasonic equipment or other suitable means acceptable to the inspector and if the remaining wall thickness is less than the minimum recorded thickness as determined by § 79.500-4 (b) it shall be used for making the calculation prescribed in § 79.500-6(b).

§ 79.500-7 Physical tests. (a) Physical tests shall be made on 2 test specimens 0.505 inch in diameter within 2-inch gauge length, taken 180 degrees apart, 1 from each ring section cut from each end of each forged or drawn tube before necking-down, or 1 from each prolongation at each end of each necked-down tank. These test specimen ring sections or prolongations must be heat treated with the necked-down tank which they represent. The width of the test specimen ring section must be at least its wall thickness. Only when diameters and wall thickness will not permit removal of 0.505 by 2-inch tensile test bar, laid in the transverse direction, may test bar cut in the longitudinal direction be substituted. When the thickness will not permit obtaining a 0.505 specimen, then the largest diameter specimen obtainable in the longitudinal direction shall be used. Specimens shall have bright surface and a reduced section. When 0.505 specimen is not used the gauge length shall be a ratio of 4 to 1 length to diameter.

(b) Elastic limit as determined by extensometer, shall not exceed 70 per cent of tensile strength for Class I steel or 85 per cent of tensile strength for Class II and Class III steel. Determination shall be made at cross head speed of not more than 0.125 inch per minute with an extensometer reading to 0.0002 inch. The extensometer shall be read at increments of stress not exceeding 5,000 pounds per square inch. The stress at which the strain first exceeds.

stress (pounds per square inch)

.....plus 0.005 (inches per inch)

30,000,000 (pounds per square inch)

shall be recorded as the elastic limit.

(1) Elongation shall be at least 18 per cent and reduction of area at least 35 per cent.

NOTE 1: Upon approval, the ratio of elastic limit to ultimate strength may be raised to permit use of alloy steels of definite composition that will give equal or better physical properties than steels herein specified

§ 79.500-8 Openings in tanks. (a) Each end shall be closed by a cover made of forged steel. Covers must be secured to ends of tank by through bolts or studs not entering interior of tank. Covers must be of a thickness sufficient to meet test requirements of § 79.500-12 and to compensate for the openings closed by attachments prescribed herein.

(1) It is also provided that each end may be closed by internal threading to accommodate an approved fitting. The internal threads as well as the threads on fittings for these openings shall be clean cut, even, without checks, and tapped to gauge. Taper threads are required and shall be of a length not less than as specified for American Standard taper pipe threads. External threading of an approved type shall be permissible on the internal threaded ends.

(b) Joints between covers and ends and between cover and attachments shall be of approved form and made tight against vapour or liquid leakage by means of a confined gasket of suitable material.

§ 79.500-9 Tank mounting. (a) For tank mounting, see § 79.10.

§ 79.500-10 Protective housing. (a) Safety relief devices, and loading and unloading valves on tanks shall be protected from accidental injury by approved metal housing, arranged

so it may be readily opened to permit inspection and adjustment of safety relief devices and valves, and securely locked in closed position. Housing shall be provided with opening having an opening equal to twice the total discharge area of safety relief device enclosed.

§ 79.500-11 Loading and unloading valves. (a) Loading and unloading valve or valves shall be mounted on the cover or threaded into the marked end of tank. These valves must be of approved type, made of metal not subject to rapid deterioration by lading or in service, and must withstand without leakage a pressure equal to the marked test pressure of tank. Provision must be made for closing service outlet of valves.

§ 79.500-12 Safety relief devices. (a) Tank shall be equipped with one or more safety relief devices of approved type and discharge area, mounted on the cover or threaded into the non-marked end of the tank. If fittings are mounted on a cover, they shall be of the flanged type, made of metal not subject to rapid deterioration by lading or in service. Total flow capacity shall be such that, with tank filled with air at pressure equal to 70 per cent of the marked test pressure of tank; flow capacity will be sufficient to reduce air pressure to 30 per cent of the marked test pressure within 3 minutes after safety relief device opens.

(b) Safety relief devices shall open at pressure not exceeding the marked test pressure of tank and not less than 7/10 of marked test pressure. (For tolerance for safety relief valves, see § 79.500-16(a).)

(c) Cars used for the transportation of flammable gases shall have the safety devices equipped with an approved ignition device.

§ 79.500-13 Fixtures. (a) Attachments, other than those mounted on tank covers or serving as threaded closures for the ends of the tank, are prohibited.

§ 79.500-14 Test of tanks. (a) After heat-treatment, tanks shall be subjected to hydrostatic tests in a water jacket, or by other accurate method, operated so as to obtain reliable data. No tank shall have been subjected previously to internal pressure greater than 90 per cent of the marked test pressure. Each tank must be tested to a pressure at least equal to the marked test pressure of the tank. Pressure must be maintained for 30 seconds, and sufficiently longer to insure complete expansion of tank. Pressure gauge must permit reading to accuracy of one per cent. Expansion gauge must permit reading of total expansion to accuracy of one per cent. Expansion must be recorded in cubic centimeters.

(b) No leaks shall appear and permanent volumetric expansion shall not exceed 10 per cent of the total volumetric expansion at test pressure.

§ 79.500-15 Handling of tanks failing in tests. (a) Tanks rejected for failure in any of the tests prescribed may be reheat-treated, and will be acceptable if subsequent to reheat-treatment they are subjected to and pass all of the tests.

§ 79.500-16 Tests of safety relief devices. (a) Safety relief valves shall be tested by air or gas before being put into service. Valve must open at pressure not exceeding the marked test pressure of tank and must be vapour-tight at 80 per cent of the marked test pressure. These limiting pressures must not be affected by any auxiliary closure or other combination.

(b) For safety relief devices of frangible disc type, samples of discs used shall burst at a pressure not exceeding the marked test pressure of tank and not less than 7/10 of marked test pressure.

§ 79.500-17 Marking. (a) Each tank shall be plainly and permanently marked, thus certifying that tank complies with all requirements of this specification. These marks must be stamped into the metal of necked-down section of tank at marked end, in letters and figures at least 1/4 inch high, as follows:

(1) Spec CTC-107A**** the **** to be replaced by figures indicating marked test pressure of the tank. This pressure shall not exceed the calculated maximum marked test pressure permitted, as determined by the formula in § 79.500-4(b).

(2) Serial number immediately below the stamped mark specified in paragraph (a)(1) of this section.

(3) Inspector's official mark immediately below the stamped mark specified in paragraph (a)(1) of this section.

(4) Name, mark (other than trademark), or initials of company or person for whose use tank is being made, which shall be recorded with the Bureau of Explosives through the Commission.

(5) Date, (such as 1-62, for January 1962) of tank test, so placed that dates of subsequent tests may easily be added thereto.

(6) Date, (such as 1-62, for January 1962) of latest test of safety relief valve or of frangible disc, required only when tank is used for transportation of flammable gases.

(7) Name of gas for which tank car is being used, stencilled in letters at least 2 inches high on each side of car where they are clearly visible.

§ 79.500-18 Inspection and reports. (a) Before a tank car is placed in service, the party assembling the completed car shall furnish to car owner, the Commission, the Bureau of Explosives, and the Secretary, Mechanical Division, Association of American Railroads, a report in proper form certifying that tanks and their equipment comply with all the requirements of this specification and including information as to serial numbers, dates of tests, and ownership marks on tanks mounted on car structure.

(b) Purchaser of tanks shall provide for inspection by a competent inspector as follows:

(1) Inspector shall carefully inspect all material and reject that not complying with § 79.500-5.

(2) Inspector shall stamp his official mark on each forging or seamless tube accepted by him for use in making tanks, and must verify proper application of heat number to such material by occasional inspections at steel manufacturer's plant.

(3) Inspector shall obtain certified chemical analysis of each heat of material.

(4) Inspector shall make inspection of inside surface of tanks before necking-down, to insure that no seams, cracks, laminations, or other defects exist.

(5) Inspector shall fully verify compliance with specification, verify heat-treatment of tank as proper; obtain samples for all tests and check chemical analyses; witness all tests; and report minimum thickness of tank wall, maximum inside

diameter, and calculated value of D, for each end of each tank as prescribed in § 79.500-4(c).

(6) Inspector shall stamp his official mark on each accepted tank immediately below serial number, and make certified report (see paragraph (c) of this section) to builder, to company or person for whose use tanks are being made, to builder of car structure on which tanks are to be mounted, to the Commission, the Bureau of Explosives and to the Secretary, Mechanical Division, Association of American Railroads.

(c) Inspector's report required herein shall be in the following form:

(Place) . . . . . .

(Date) . . . . . .

STEEL TANKS

It is hereby certified that drawings were submitted for these tanks under AAR Application for Approval.....and approved by the AAR Committee on Tank Cars under date of . . . . . .

Built for .....Company

Location at . . . . . .

Built by . . . . . .Company

Location at . . . . . .

Consigned to.....Company

Location at . . . . . .

Quantity .....

Length (inches) . . . . . .

Outside diameter (inches) .....

Marks stamped into tank as required in § 79.500-17 are:

CTC-107A****

NOTE 1: The marked test pressure substituted for the **** on each tank is shown on Record of General Data on Tanks attached hereto.

Serial numbers.....to.....inclusive

Inspector's mark. . . . . .

Owner's mark . . . . . .

Test date . . . . . .

Water capacity (see Record of Hydrostatic Tests).

Tare weights (yes or no). (See Record of Hydrostatic Tests).

These tanks were made by process of . . . . . .

Steel used was identified as indicated by the attached list showing the serial number of each tank, followed by the heat number.

Steel used was verified as to chemical analysis and record thereof is attached hereto. Heat numbers were stamped into metal.

All material was inspected and each tank was inspected both before and after closing ends; all material accepted was found free from seams, cracks, laminations, and other defects which might prove injurious to strength of tank. Processes of manufacture and heat-treatment of tanks were witnessed and found to be efficient and satisfactory.

Before necking-down ends, each tank was measured at each location prescribed in § 79.500-4(c) and minimum wall thickness in inches at each location was recorded; maximum inside diameter in inches at each location was recorded; value of D in inches at each location was calculated and recorded; maximum fibre stress in wall at location showing larger value for

$$\frac{D^2 + d^2}{D^2 - d^2}$$

was calculated for 7/10 the marked test pressure and recorded. Calculations were made by the formula:

$$S = 0.7P \frac{(D^2 - d^2)}{(D^2 + d^2)}$$

Hydrostatic tests, tensile tests of material, and other tests as prescribed in this specification, were made in the presence of the inspector, and all material and tanks accepted were found to be in compliance with the requirements of this specification. Records thereof are attached hereto.

I hereby certify that all of these tanks proved satisfactory in every was and comply with the requirements of the Canadian Transport Commission, Specification No. 107A****.

(Signed) . . .

(Inspector)

(Place) . .

(Date) .

RECORD OF CHEMICAL ANALYSIS OF STEEL FOR TANKS

Numbered .....to .....inclusive

Size.....inches outside diameter by.....inches long

Built by .....Company

For. . . . . Company

Heat No.	Tanks represented (Serial Nos.)	Chemical analysis							
		C	Mn	P	S	Si	Ni	Cr	Mo

These analysis were made by

(Signed) . . . . . .

(Place) . . . . .

(Date) . . .

RECORD OF TENSILE TESTS OF MATERIAL IN TANKS

Numbered . . . . . to . . . . . inclusive

Size.....inches outside by.....inches long

Built by . . . . . Company

For. . . . . .Company

Heat No.	Tanks represented by test (Serial Nos.)	Elastic limit (pounds per square inch)	Tensile strength (pounds per square inch)	Elongation (per cent in 2 inches)	Reduction of area (per cent)

(Signed) . . . . . .

(Place) . .

(Date) . . . . . .

RECORD OF HYDROSTATIC TESTS ON TANKS

Numbered .....to .....inclusive

Size.....inches outside by.....inches long

Built by . . . . . Company

For.....Company

Serial Nos. of tanks	Actual test pressure (pounds per square inch)	Total expansion (cubic centimeters)[1]	Permanent expansion (cubic centimeters)[1]	Per cent ratio of permanent expansion to total expansion[1]	Tare weight (pounds)	Capacity in pounds of water at 60°F.

If tests are made by method involving measurement of amount of liquid forced into tank by test pressure, then the basic data on which calculations are made, such as pump factors, temperature of liquid, coefficient of compressibility of liquid, etc., must also be given

[2]Do not include protective housing, but state whether with or without valves

(Signed)

(Place)

(Date)

RECORD OF GENERAL DATA ON TANKS

Numbered .....to .....inclusive

Built by.....Company

For. . . . . Company

Serial No. of tank	Data obtained as prescribed in § 79.500-4 (c)							Larger value of the factor $\frac{D^2 + d^2}{D^2 - d^2}$	(S) Calculated fibre stress in pounds per square inch at 7/10 marked test pressure	Marked test pressure in pounds per square inch stamped in tank	Minimum tensile strength of material in pound per square inch recorded
	Marked end of tank			Other end of tank							
	(t) Minimum thickness of wall in inches	(d) Maximum inside diameter in inches	(D) Calculated value of D in inches = d + 2t	(t) Minimum thickness of wall in inches	(d) Maximum inside diameter in inches	(D) Calculated value of D in inches = d + 2t					

(Signed)

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